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THE NEW SYDENHAM SOCIETY.

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VOLUME CXIX.

A

TEXT BOOK OF MIDWIFERY.

BY THE LATE

OTTO SPIEGELBERG,

Professor of Obstetric Medicine in the University of Breslau.

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TRANSLATED FROM THE SECOND GERMAN EDITION

BY

J. B. HURRY, M.A., M.D., *Cantab.*

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S. 102.

OTTO SPIEGELBERG[1]

was born January 9, 1830, at Peine in Hanover, and after receiving his classical education at Hildesheim, entered the University of Göttingen at the age of 18. There he began to study Midwifery under E. C. J. Von Siebold, and soon developed a strong liking for this department of Medicine. In 1852 he visited Vienna, and afterwards England, Scotland, and Ireland, in order to study the methods of procedure in the Lying-In Institutions of these countries. Shortly after his return to Göttingen he published (1858) an excellent Compendium of Midwifery, and in 1860 was appointed Professor Extraordinarius of Midwifery in the University. The following year he was called to Freiburg as Prof. Ordinarius, and two years afterwards (1864) removed to Königsberg, which however he again quitted on being appointed (1865) Professor at Breslau.

In 1870 in conjunction with Credé, S. started the *Archiv für Gynäkologie*, and throughout his life was a constant and valuable contributor. Meanwhile he was accumulating a large practice, which however did not prevent him from devoting much time to the great work with which his name is mainly associated, viz. the *Lehrbuch der Geburtshülfe*, of which the following pages are a translation. The *Lehrbuch* appeared in 1878, and became so popular that in 1880 a 2nd edition was called for, and S. was far advanced with its preparation at the time of his death.

Symptoms of failing health appeared in the summer of 1880, but so great was S.'s enthusiasm for his work, that it was with difficulty that he could be persuaded to abandon it for a season.

---

[1] For the various facts relating to the life of Spiegelberg, I am indebted to a Memoir by G. Leopold, published in the *Archiv f. Gynækologie*, vol. xviii., 1881.

A change to the Riviera and elsewhere restored him temporarily, but before long the symptoms returned in an aggravated form, and on the 9th of August 1881 he passed away. The cause of death proved to be hypertrophy of the heart and contracted kidneys.

The unfinished portions of the 2nd edition were edited by Dr. Wiener, late assistant to Spiegelberg.

J. B. H.

PREFACE TO THE FIRST EDITION.

AT the outset of my career as teacher and practitioner, nearly twenty years ago, I wrote a Compendium of Midwifery which the publishers intended should form one of a series of text books, and which met with a far more cordial reception than I had anticipated. During the next few years however of my clinical activity, I had neither time nor inclination for a more complete and revised treatise, and before long my removal to another sphere of work, which happened more than once, also proved an obstacle.

When later on I found the necessary leisure, the need for a Compendium had passed away. It seemed to me however that a complete treatise of Obstetrical Science, showing what progress had been made both in theory and practice during the last twenty years, and how greatly the science had been advanced by fresh researches, would be a useful undertaking. Especially did I venture to hope that the wide gap which still separates the Midwifery as taught in our hospitals and medical schools, and that of ordinary practice might be partly bridged over. Such was the origin of this text book. My last object obliged me to treat the subject from a clinical stand-point.

I have endeavoured as far as possible to summarise the accumulated literature of our science; my own researches have been interspersed with it, for I could not think of exposing them more than could be avoided to the criticism of brother obstetricians. The fact that the first portions of this book have already been in type for two years, will explain why a few of the more recent researches have received somewhat scanty notice.

In arranging my material I have generally followed the established custom, although it is sometimes necessary in a clinical work to bring together sections which have no logical connection.

In the literature appended to each chapter, I have mainly confined myself to recent publications; the earlier ones are quoted in them and can thus be easily referred to. A complete bibliography would have increased the size of my book without any corresponding advantage. The distance at which I was from the publishing office will, I trust, excuse a few typographical errors; they are unimportant.

In conclusion I must thank the Publishers for the admirable way in which my text book has been brought out, better perhaps than the contents deserve.

SPIEGELBERG.

September, 1877.

PREFACE TO THE SECOND EDITION.

THE cordial reception which Spiegelberg's Text Book of Midwifery met with throughout the medical world, soon made it necessary to allow a new edition of the work to appear. Unfortunately however its completion took longer than was originally anticipated, owing in part to the severe illness of the author, and in part to the fact that after his death the request to complete the unfinished work found the undersigned totally unprepared to undertake it.

Spiegelberg did his utmost in the second edition, as he had done in the first, to examine critically the most recent contributions to the literature of the subject, and to give prominence to the latest acquisitions of our science, so that this edition has been enriched in a degree which is by no means inconsiderable, and corresponds to the advance of recent midwifery. But death overtook the indefatigable man in the midst of his ceaseless activity, and robbed him of the joy of seeing his work completed.

Entrusted with the honourable task of completing the remaining portion of the text book of my teacher and friend (including Puerperal Fever and Obstetric Operations), I have endeavoured, as far as was in my power, to fulfil this task in the spirit of him who has passed away. I have not ventured to make any important alteration in the contents and arrangement of the previous edition, bearing in mind the many good qualities which have been so generally recognised. Moreover it was desirable to retain the character of the book which it received from its author.

I have therefore sought to incorporate as much as possible the results of the most recent investigations with the work which has already appeared, and have only in a few places used different expressions to those of the earlier edition.

Amongst the papers bequeathed by Spiegelberg, I found a manuscript of his friend Dr. Matthews Duncan of London, containing very valuable criticisms on the first edition. Spiegelberg used this manuscript with great advantage, and I have done so also with the special permission of the Author, and I believe I am acting in accordance with Spiegelberg's wish, in here expressing to his friend the grateful acknowledgment which he deserves for the service he has rendered to this Text Book.

WIENER.

BRESLAU, *May*, 1882.

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INTRODUCTION.

§ 1. The study of Midwifery, according to the meaning of the word, includes the science and art which relate to the act of parturition, both under normal and abnormal conditions.

But parturition constitutes only one of a series of events, which begin with conception and end with the puerperal state. The various phenomena which accompany parturition can therefore only be fully appreciated when considered in relation to the development which has preceded them; their significance is often manifest only in relation to the puerperal state. The province of Midwifery must therefore be extended; pregnancy and the puerperal state must be included in its teaching. Thus Midwifery comes to be the *Study of the Processes of Reproduction*, of the *Child-bearing Period* in its wider sense; indeed it forms a division of Gynækology, of which another division deals with the remaining sexual functions under healthy and morbid conditions.

§ 2. The object of Midwifery is to render assistance to woman during pregnancy, childbirth, and the puerperal state, whether these events follow a normal or an abnormal course. Hence arises a natural division of the subject-matter of the following work. The *first part* comprises a description of the ordinary course of events and of the appropriate treatment to be followed; the *second* deals with abnormal events and the assistance that can be rendered in such cases; thus the physiology and hygiene, the pathology and therapeutics of the puerperal processes are all included. The means to be employed will of course vary greatly, being sometimes *hygienic and pharmaceutical*, sometimes *mechanical and operative*.

The operative measures are for the most part special to Midwifery, and constitute a large share of its therapeutics. A special chapter will therefore be devoted to their description under the head of *Obstetrical Operations*.

§ 3. From this definition of the scope of "Midwifery," it at once becomes evident what preliminary knowledge the student of the subject must possess. Especially must he be familiar with anatomy, physiology (particularly that of the female sexual organs) and embryology, for Midwifery can no more include the latter amongst its branches of study, than it can pathological anatomy, general pathology, therapeutics &c. It can only refer to them as far as is requisite to make the whole subject intelligible.

Nevertheless we cannot altogether exclude a consideration of the organs directly concerned in the puerperal processes, namely the generative organs and the pelvis, at any rate as far as their relations and proportions are of importance in regard to those processes, all the more as those characters are not specially considered in anatomical lectures, and above all are not studied from an obstetrical point of view. The same is true of the impregnated ovum. Such a description is therefore desirable as takes a knowledge of purely anatomical facts for granted, and only deals with them so far as they concern the gynækologist. Thus a description of the female pelvis and its contents forms the introductory portion of Midwifery[1].

---

[1] The description of the embryo and its appendages can only be given in the second part, inasmuch as it assumes at several points a knowledge of the changes in the uterus brought about by pregnancy.

PART I.

THE ABDOMINAL CAVITY, PELVIS AND GENERATIVE ORGANS (THE PARTURIENT CANAL).

§ 4. As already stated in the Introduction, we cannot here attempt to give a full account of the pelvis and its contents. We must however describe the relations of the organs which are concerned in childbirth, and indicate the peculiarities in their structure and arrangement, so far as these are directly connected with the development and expulsion of the embryo. This is necessary to enable the reader to start with a clear conception of the origin of the processes which he is about to study, both from a physiological and a pathological point of view, and thus to make them more intelligible.

1. *The Abdominal Cavity.*

§ 5. The abdominal cavity forms a more or less barrel-shaped cylinder, flattened from before backwards and terminated at both ends by a concave surface. The walls are formed mainly by soft parts, which above are attached to the ribs, and below are fixed and supported by the pelvic girdle and the vertebral column in such manner that they cannot collapse, but are always more or less tense. The superior and inferior walls, constituting the diaphragm of the thorax and the diaphragm of the pelvis, are formed by soft parts which present uniform concavities looking towards each other. The anterior wall, likewise concave, is membrano-muscular, except in its lowest portion. The side walls are everywhere bony, except in their middle portion, where they are soft. The posterior wall is altogether bony in the middle line, and on each side it is so also, except over a small area where the muscles attached to the spinal column (M. quadratus lumborum) take the place of bone.

§ 6. It is clear therefore that the *shape of the abdomen* must vary greatly according to the degree of its repletion and the thickness of its parietes, so that any one familiar with the position of the organs, and the elastic and the solid structures bounding the cavities and tubes contained in the abdomen, will be able from a mere inspection to decide with a fair degree of confidence as to the nature of any change that has taken place.

In the ordinary condition sections passing through the various planes of the abdomen will have some such relations as the following:—

A *coronal section* will have an outline approximately resembling two circles intersecting each other, of which the larger lies below, the smaller above the anterior superior iliac spines. The better made the woman, the more obvious is this relation even to the ordinary observer in the curving waist and the moderate prominence of the hips. In the habitus of the child or the man the curve is converted into a straight line, while during pregnancy the interval between ribs and ilium becomes bulged, and the convexity of the line is directed outwards.

A *horizontal* section has more similarity in its outline to that of a heart or kidney, according to the elevation at which it passes; the higher the section, the more does the outline become heart-shaped; the lower down, the more reniform. The transverse diameter is here larger than the sagittal or antero-posterior, and has its greatest width between the two anterior superior iliac spines. In pregnancy, on the other hand, the sagittal diameter measures more than the transverse, and is greatest at the level of the umbilicus.

§ 7. A *section passing through the median sagittal plane* has in its upper and middle portion almost the outline of an ellipse, the regularity of the figure being chiefly disturbed by the S-shaped curve of the vertebral column, which is most marked in the lumbar and sacral regions, and is convex forwards. In a normal figure the curve in the lumbar region seen from behind, forms a gentle concavity, which passes gently into the convexities of the thoracic and sacral regions. Deviations from this normal appearance are so characteristic, that the presence of co-existing peculiarities of the pelvis may safely be inferred. Pregnancy necessitates a modification of this curve, for, as the centre of gravity is shifted forwards, the woman is obliged to lean backwards in order to preserve her equilibrium, and in so doing she causes an increase in the lumbar curve. Slight lateral curvatures of the abdominal region of the vertebral column, compensatory of the curve to the right side in the dorsal region, are present in almost all persons.

§ 8. The *dimensions* of the abdominal cavity are important. The height averages 40—45 cm. (15·5—17·5 in.), about a quarter of the length of the body; the transverse diameter is about 35 cm. (13·5 in.). The capacity can be easily calculated from the weight of the contained organs, inasmuch as they entirely fill the cavity. Altogether they weigh 6—7 kilogrammes (13—15·5 lb.); their specific gravity varies from 1·02—1·07; we cannot therefore go far wrong in estimating the contents at from 6—7 litres (10—12 pints).

§ 9. As is well known, the alimentary canal and the large glands belonging to it, together with the spleen, kidneys and generative organs, form the *contents* of the abdominal cavity. These sets of organs are connected with each other and with the abdominal walls by the peritoneum, a membrane which lines the under surface of the diaphragm, is reflected from there on to the liver, stomach and spleen, enveloping these organs, and connecting them closely together by means of the gastro-hepatic and gastro-splenic omenta. The two laminæ of peritoneum derived from the anterior and posterior surfaces of the stomach, form a long apronlike fold which generally reaches to the entrance of the pelvis—the great omentum. From the first-mentioned organs the peritoneum also turns back towards the spinal column, adhering firmly to it and sending forwards from it the mesenteric folds to envelop the small intestine with their anterior borders. On either side it passes down in front of the fossa lumbaris as a smooth membrane, and meets here with the ascending and descending colon, which in the great majority of cases it only covers on the anterior surface. At the level of the iliac fossa it reaches the serous membrane lining the lateral and anterior abdominal wall, and on the right side partly covers the cæcum. Lastly, it sinks into the pelvic cavity as a closed sac, stretching from the symphysis pubis to the middle of the first sacral vertebra, on a level with the ilio-pectineal crest, and at the upper border of the anterior wall of the pelvis it is continued on to the anterior abdominal wall. This pelvic pouch is partly inverted by the uterus with the Fallopian tubes, which are set in it, and thus are formed two pockets, one lying in front of, the other behind the uterus, deepest in the middle and lined by a membrane which passes insensibly at each side into that lining the iliac fossæ.

§ 10. The serous membrane therefore divides the abdomen into two secondary cavities, an anterior or *intra-peritoneal* cavity, which contains the alimentary canal, liver, spleen, great omentum and mesenteries, and a posterior lower or *extra-peritoneal* cavity, containing the pancreas, supra-renals, kidneys, part of the cæcum, the lowest division of the rectum, the vagina and cervix uteri, the urethra and the lower part of the bladder. The peritoneal cavity may be looked upon as a great lymph-sac, closed everywhere except at two small spots where it communicates with a mucous surface, and thus with the outer world (ovary and orifice of the Fallopian tube). These two cavities are so related to each other, that one of them can increase in size at the expense of the second, and an organ belonging to the posterior lower one, can for a time lie almost entirely in the anterior upper one, or at any rate project into it to an enormous extent. At the same time the separate viscera are in close contact and exposed everywhere to an equal pressure, though this will vary with the varying degree of distention of the abdominal cavity, with the different postures and attitudes of the body, and with the degree in which the latter is supported, also with the weight borne by the spinal column, and especially with any bodily exertion or abdominal straining; this pressure is mainly supported by the floor of the pelvis.

§ 11. To assist the reader in obtaining a clear idea of the relative position of the abdominal viscera, I add a sketch of their *topography*.

In the *epigastrium* are portions of the right and left hepatic lobes, and the middle and pyloric divisions of the stomach; deeper down are the terminations of the duodenum and pancreas; and still further from the surface, the aorta, inferior vena cava, solar plexus and the cæliac axis. The stomach when distended pushes the liver up, the transverse colon down and the anterior abdominal wall forwards, but when empty it lies under the diaphragm, the liver and colon being in front of and almost entirely covering it.

The right *hypochondrium* is filled by the right lobe of the liver, the edge of which, in women who have borne children, usually projects somewhat beyond the edge of the ribs. Under the liver in this situation lies the right end of the transverse colon, further back the supra-renal capsule and sometimes the upper part of the right kidney. In the left hypochondrium is situated the cardiac end of the stomach, and the spleen still more to the left; below this lies the left side of the transverse colon, the left supra-renal capsule with the upper part of the kidney.

The *mesogastrium* contains in its middle portion the great omentum; beneath this lie above the transverse colon, lower down the largest part of the coils of the small intestine; beneath these are the aorta and vena cava, with their branches. On the right side lie some more coils of small intestine, further outwards the ascending colon, and behind it the kidney. The same is true of the left side, except that the descending colon is placed further outwards. The lumbar region has in its middle portion the vertebral column; on the sides of the latter the lower end of the kidneys, outwards from which lies the posterior wall of the great intestine, generally devoid of peritoneal covering.

The *hypogastrium* contains the lower half of the coils of small intestine, and the bifurcations of the aorta and vena cava which lie at the level of the pelvic brim; in its deepest portion are the pelvic organs, which when distended project more or less into the hypogastrium. The only organ which is usually found in contact with the lower third of this region of the abdominal wall, is the bladder, provided it is not quite empty. In the iliac fossæ lie coils of small intestine, and somewhat higher up on the right side is the cæcum, on the left the commencement of the sigmoid flexure. (The description of the pelvic cavity will be given below.)

LITERATURE.

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Schatz, "Der Intraabdominelle Druck," *Arch. f. Gyn.*, iv. and v., 1872—1873.

2. *The Pelvis.*

§ 12. The pelvis is composed of the two ossa innominata, which are more or less hour-glass in shape and constitute the lower limb-girdle, and of the spadelike sacrum with the triangular coccyx, the point of which is directed downwards. From an obstetrical point of view we must also add the two lowest lumbar vertebræ with their ligaments.

Looked at as a whole, the pelvis resembles a deep plate with a broad, flat, and in several places interrupted rim. The boundary between the latter and the deepened portion, is only well defined and sharp on the internal surface, and is there indicated by a line which passes from the symphysis pubis over the iliopectineal crest of the two ossa innominata, over the rounded border on the lateral portions of the sacrum, obliquely upwards to the middle of the synchondrosis, between the last lumbar and the first sacral vertebra (*promontory*), and is called the *linea innominata* or *terminalis*. The plane bounded by this line is called the pelvic inlet, or upper pelvic aperture (fig. 1). Its shape is somewhat elliptical, but according as the promontory projects much or little, approaches the outline of a kidney or a heart. The portion of the pelvis situated above the linea innominata is called the *great* (or *false*) *pelvis*, the canal below that line forms the *small* (or *true*) *pelvis*.

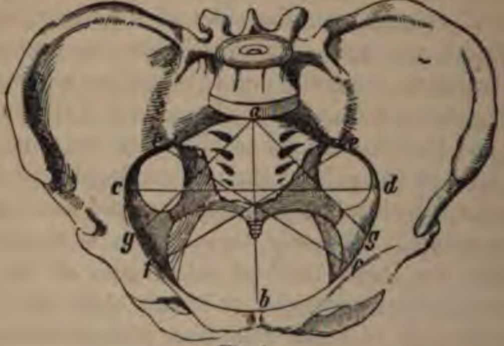

Fig. 1.

The Great Pelvis.

§ 13. The great pelvis is mainly formed by the shovellike expansion of the iliac bones and the two last lumbar vertebræ lying between them; in a less degree by the alæ at the base of the sacrum and by the upper surface of the pubic bones. These bones contribute to some extent to the formation of the abdominal wall, the intervals between them being completed behind by the muscular and tendinous structures which are in contact with the last lumbar vertebræ, and in front by the lower portion of the anterior abdominal wall.

It is therefore only in its transverse diameter and depth that the ring thus formed can have constant dimensions.

The distance between the two anterior superior iliac spines is called the *small or anterior transverse diameter* (Sp. I.), and measures .... 23 cm. (9 in.).

The greatest distance between the two iliac crests is near their middle, and is called the *great or posterior transverse diameter* (Cr. I.); it measures .... 25 cm. ($9\frac{3}{4}$ in.).

A line drawn from the last diameter perpendicularly to the pelvic brim (*depth* of the great pelvis) measures on an average .... 7·5 cm. (3 in.), and one carried from the highest points of the iliac crests to the brim, about .... 6 cm. (2·5 in.).

The *width* of the great pelvis diminishes from above downwards, indeed the lateral surfaces converge so rapidly, that if prolonged below they would meet at about the level of the fourth sacral vertebra; the surfaces of the innominates are therefore oblique. The *depth* is almost uniform along the sides, but diminishes gradually both in front and behind, owing to the important gaps that are situated there.

The Small Pelvis.

§ 14. The small pelvis—the pelvis of common parlance—forms an approximately cylindrical canal directed backwards and downwards, whose inlet and outlet are somewhat narrowed in comparison to its cavity. It is composed of the pubic and ischial bones, of the sacrum and coccyx. Although the several walls that bound the cavity pass into one another by means of sloping surfaces without sharp boundaries, it is possible to distinguish an anterior, a posterior and lateral walls. The anterior wall is bounded by two lines, which pass on each side from the ilio-pectineal eminence, along the outer edge of the foramen ovale to the middle of the tuberosities of the ischia (fig. 2); the posterior is formed by the anterior surface of the sacrum and coccyx. The lateral walls lie between these two; a perpendicular line drawn through the base of the ischial spine on each side, divides them into an anterior half which is wholly bony and belongs to the ischium, and a posterior which is mainly membranous (fig. 3).

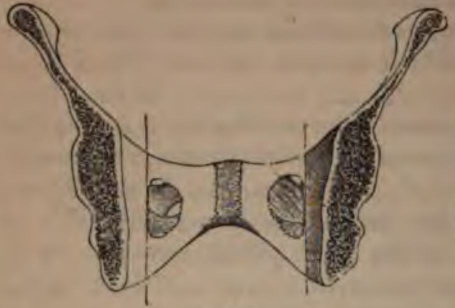

Fig. 2.

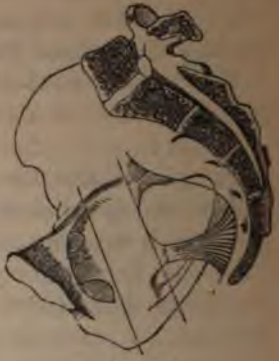

Fig. 3.

§ 15. The small pelvis is not everywhere of uniform *depth*, owing to the great gaps in its inferior border. There are three such gaps, one antero-median, and two latero-posterior. The former is bounded by the lower edges of the rami of the ischial and pubic bones, which converge above and in front, the summit being at the lower margin of the pubic synchondrosis. It constitutes an arched interval rounded off by the subpubic ligament, and forming an angle of 95°—100° (*arcus pubis*). The pubic and ischial rami bounding this arch are called the pillars of the pubic arch; their lower border is flat, becoming convex in front, and excavated further down.

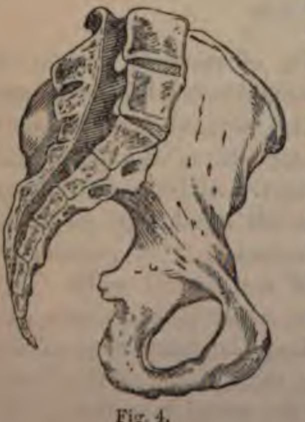

Fig. 4.

The gap in the lateral wall is the *incisura sacro-ischiadica*, whose greatest diameter runs forwards and upwards. It is rounded off above, limited in front by the posterior edge of the os innominatum, behind by the lateral border of the sacrum and coccyx, and is separated by the sacro-sciatic ligament from the lower pelvic aperture.

The depth of the small pelvis is as follows (fig. 4): behind (arc of the curve between the promontory and the point of the coccyx), ca. 13 cm. (5 in.); at the sides, from the middle of the linea innominata to the middle of the tuberosity of the ischium, 9·5 cm. (3·75 in.); in front, along the middle line (depth of the symphysis pubis), 4·5 cm. (1·75 in.).

The depth of the whole pelvis, from the highest point of the iliac crest to the tuberosity of the ischium, is on its outside 19·5 cm. (7·5 in.).

§ 16. Inasmuch as the dimensions of the pelvic canal vary in its different regions, it is necessary to consider the latter one by one—viz., the upper aperture or *inlet*, the lower or *outlet*, and the *cavity* lying between them.

The *inlet* of the pelvis is included within the linea terminalis. The *outlet* (fig. 5) is limited in front by the pubic arch and its pillars, laterally by the tuberosities of the ischia, and behind by the lower border of the sacro-sciatic ligaments and by the borders and apex of the coccyx. Its boundaries are bony in front of the tuberosities of the ischia, but behind them are composed of soft parts, between which in the middle line the coccyx forms a projection. The opening has a rhomboidal shape, and lies in more than one plane; the lateral boundaries lying about 3 cm. (1·2 in.) deeper than a median line drawn from the anterior to the posterior margin, a fact which is of obstetrical importance. A horizontal line connecting the lowest points of the two tuberosities divides the outlet into two triangles, the common base of which it forms; the anterior triangle is directed backwards and downwards, the posterior forwards and downwards.

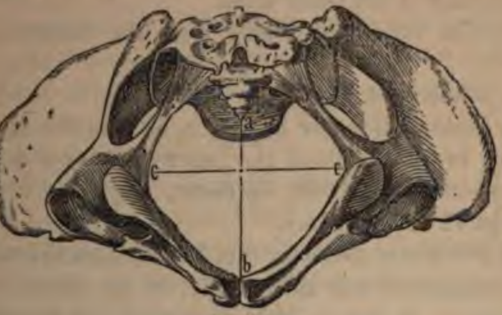

Fig. 5.

The pelvic *canal* is widest at its middle, and becomes somewhat narrower towards the outlet. The widest portion—*pelvic dilatation*—is bounded by a line running from the middle of the symphysis over the upper border of the obturator foramen, in the neighbourhood of the acetabulum, to the point of union of the second and third sacral vertebræ (fig. 6). Its outline approaches that of an oval directed from before backwards. The narrowest portion—*pelvic strait*—is the almost circular region which is bounded by the end of the sacrum, the spines of the ischia and the summit of the pubic arch.

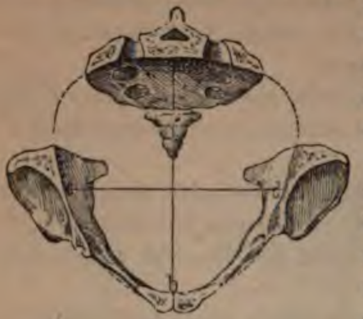

Fig. 6.

§ 17. These various divisions have the following measurements :—[1]

A. The *pelvic inlet.*

1. The *sagittal diameter* (fig. 1, *a*, *b*) from the middle of the promontory to the middle of the inner and upper border of the symphysis—*antero-posterior diameter, conjugata vera*[2] (C. v.) —measures 11 cm. (4·3 in.).

2. The *transverse diameter* (fig. 1, *c*, *d*) from the middle of the linea innominata of one side to that of the other (D. tr.) 13·5 cm. (5·3 in.). It lies a little nearer to the sacrum than to the anterior wall of the pelvis.

3. The *oblique diameter* (*e*, *f*) from the sacro-iliac synchondrosis of one side to the ilio-pectineal eminence of the other—(D. obl.) 12·5 cm. (4·9 in.). That drawn from the right sacro-iliac synchondrosis is called the *right or first*, that drawn from the left is called the *left or second oblique diameter.*

4. The distance of the middle of the promontory from the upper and posterior portion of the floor of the acetabulum of

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[1] These measurements are of course the averages obtained by different authors in measuring perfectly normal pelves. There is therefore a pelvis which is slightly smaller than the average, and yet must not be looked upon as abnormal. Thus in Breslau I find that the figures are as a rule somewhat smaller than those I used to obtain in Königsberg and Freiburg, a fact which is doubtless to be associated with the striking differences in the physique and stature of the populations referred to.

[2] A conjugate is the small axis of an ellipse.

each side (*a, g*)—*distantia sacro-cotyloidea* (D. s. cot.)—9 cm. (3·5 in.).

The circumference of the pelvic inlet measures about 40 cm. (15·5 in.).

§ 18. B. The *pelvic dilatation* (fig. 6).

1. The *antero-posterior diameter*, from the point of union of the second and third sacral vertebræ to the middle of the symphysis (*a, b*)—12·75 cm. (5 in.).

2. The *transverse diameter*, between those points of the acetabula which are highest in the erect posture (*c, d*)—12 cm. (4·75 in.).

3. The *oblique diameter*, from the middle of the upper edge of one incisura ischiadica major to the upper circumference of the sulcus obturatorius of the opposite side—13·5 cm. (5·25 in.).

C. The *pelvic strait*.

1. The *antero-posterior diameter* from the point of the sacrum to the lower edge of the symphysis—11·5 cm. (4·5 in.).

2. The *transverse* between the points of the two ischial spines (Sp. Isch.)—10 cm. (4 in.).

D. The *pelvic outlet* (fig. 5).

1. The *antero-posterior diameter* from the point of the coccyx to the lower edge of the symphysis (*a, b*)—9·5 cm. (3·75 in.). It can be increased during parturition by the recession of the movable coccyx in the direction of this diameter of the pelvic strait to 11·5 cm.[1] (4·5 in.).

2. The *transverse* from one tuberosity to the other (*c*)—11 cm. (4·25 in.).

3. The *oblique diameters* from the middle of one sacro-sciatic ligament to the opposite pubo-ischiadic synostosis—11 cm. (4·25 inches). They may, when the ligaments are stretched, be increased by from 1 to 1·5 cm. (·4—·6 in.), and have therefore no special practical importance.

§ 19. If the measurements given above are tabulated, the reader will not only obtain a clearer conception of them, but the comparison will give a very instructive insight into the space-relations of the various regions of the pelvis; especially if the conjugata vera is taken as a standard which we will call 100, and the other diameters are compared with it.

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[1] According to Lang's investigations (*Ueber die Beweglichkeit des Steissbeines und ihre Beziehung zu der Geburt, Diss.* Bern, 1878), the average range of movement of the coccyx amounts in primiparæ to 1·65 cm. (·6 in.) before birth to 2·7 cm. (1 in.) after it. In the case of multiparæ to 2 cm. (·8 in.) and 2·7 cm. (1 in.) respectively.

	Antero-posterior.	Transverse.	Oblique.	Sp. Isch.
Inlet	11 cm.=100	13·5 cm.=122·7	12·5 cm.=113·6	
Cavity (pelvic dilatation)	12·75 cm.=115·9	12 cm.=109	13·5 cm.=122·7	10 cm.=90·9
Outlet (fixed diameter)	11·5 cm.=104·5	11 cm.=100		

This table shews that the pelvis offers most room at its inlet in the transverse direction, in its cavity in the oblique and at its outlet in the antero-posterior direction, a course therefore which a body passing through it and meeting with resistance will follow. At the same time it must be noticed that this resistance will gradually increase in a transverse direction, on account of a gradual diminution of the transverse diameter from above downwards, and that the cavity and the outlet will afford most room

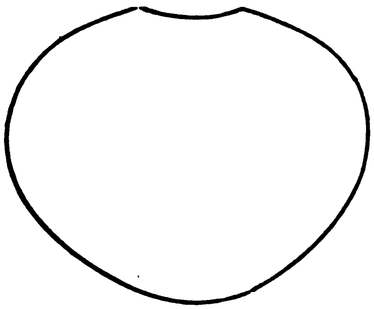
Fig. 7.
Normal pelvic inlet.
(After Hegar.)

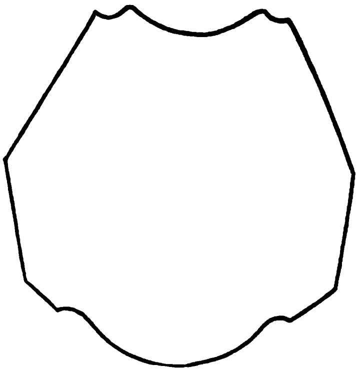
Fig. 8.
Pelvic dilatation.

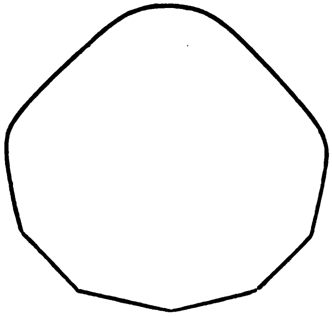
Fig. 9.
Pelvic strait.

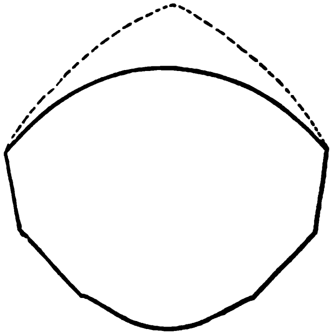
Fig. 10.
Pelvic outlet.

in an oblique direction, owing to the size of the oblique diameter of the first and the capacity for elongation (figs. 7—10) of the second.

§ 20. In order correctly to estimate the size of the pelvis, the following distances also are important and therefore to be noted:—

The distance at which the point on the posterior edge of the symphysis lying nearest to the middle of the promontory, is from the latter—conjugata vera in the *obstetrical sense*—10—10·25 cm. (3·9—4 in.). The anterior extremities of the anatomical and obstetrical conjugata vera are separated from each other by about 1 cm. (·4 in.).

The distance of the middle of the promontory from the summit of the pubic arch—*conjugata diagonalis* (C. d.)—12·5 cm. (4·9 in.).

The distance of the spinous process of the last lumbar vertebra from the upper anterior edge of the symphysis—*conjugata externa* (C.E.) or *Baudelocque's diameter* (D.B.)—19—20 cm. (7·5—8 in.).

The distance between the posterior superior spines of the iliac bones—10 cm. (4 in.).

The greatest distance between the trochanters when the thighs are adducted (Tr.)—31 cm. (12 in.).

The numerous other external pelvic measurements generally added by authors are mostly oblique, and drawn from definite points of the whole pelvis to definite points on the opposite side (external oblique measurements); they have only a relative value, inasmuch as they serve to compare the two sides of the pelvis. (Further remarks on this subject will be found under "Pelvimetry.")

§ 21. Apart from an enlargement of the outlet caused by the recession of the coccyx, no *increase* in the *size of the pelvic cavity* is possible. The relaxed and swollen condition of the movable pelvic articulations, which sometimes accompanies pregnancy, and which may be developed to a pathological degree, is not of any assistance to the forces which during parturition act everywhere equally from within outwards, and tend to separate the pelvic bones from each other. Such a separation could only take place by the interspaces at the three articulations increasing in size, and for this an arrangement is wanting, by means of which the vacuum arising from the separation of the pelvic bones could be filled. The movement permitted at the ilio-sacral and pubic synchondroses, has no other result than to break the force of the shocks to which the pelvis is exposed, and merely shows itself in a gliding of the surfaces over one another upwards and downwards, or forwards and backwards. If, however, the tissues become abnormally softened during pregnancy, an increased degree of mobility may set in, which materially interferes with the steadiness and security of the woman when standing or walking.

The Inclination of the Pelvis.

§ 22. The pelvis does not lie in the axis of the body, but forms with the vertebral column an angle of from 130°—140°; its inlet lies therefore in a plane whose anterior edge is inclined downwards, and the degree of this *inclination* is defined by the angle which the antero-posterior diameter of the inlet forms with the horizon (x, fig. 11). This angle varies from 55°—64°, but averages 60°.

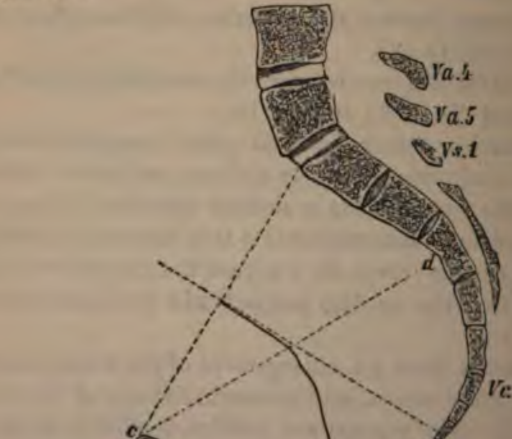

Fig. 11.

The plane in which the antero-posterior diameter of the pelvic outlet lies has also this downward inclination, but to a much smaller extent, for the angle which it forms with the horizon (y) varies from 7°—27° and averages 12°.

A plumb-line passing through the middle point of the pelvic inlet, would pierce the abdominal wall somewhere in the neighbourhood of the umbilicus, and below strike the end of the coccyx. A similar line starting from the middle of the outlet, would strike the promontory.

The promontory is about 9·5 cm. (3·75 in.) higher than the upper edge of the symphysis; the point of the coccyx about 1·7 cm. (·7 in.) higher than the top of the pubic arch. In order to give a pelvis its natural position in relation to the horizon, the anterior superior iliac spines and the two pubic tubercles must be in one vertical plane, or the posterior ends of the acetabular notches must look directly downwards.

§ 23. Since the direction of the conjugate depends on all those influences which affect the position of its extremities, the degree of pelvic inclination must be subject to many alterations; the position of the promontory is especially variable. According to Meyer's observations, the inclination of the pelvis in different individuals varies much more than had been previously supposed, and even in the same individual there are very great differences, dependent on the degree of divergence or convergence, and on the amount of rotation of the thighs. The minimum inclination is 40°—50° and is associated with slight divergence (25°) and slight inward rotation (10°) of the thighs; the maxima are met with when extreme convergence and divergence of the thighs accompany strong inward or outward rotation and amount to 100°. When a person stands in an unconstrained manner with parallel legs, the pelvis is inclined about 55°.

Parow believes that the direction and normal curvature of the vertebral column are affected by the inclination of the pelvis, and are no more constant than is the latter; the inclination of the conjugate, according to him, has a definite but inverse relation to the inclination of the posterior surface of the sacrum, so that by measuring the inclination of the sacrum in a living person, that of the pelvis may be obtained.

For estimating the great variations of the angle of inclination of the inlet, the so-called *normal conjugate* of Meyer seems most useful. It is a line whose posterior extremity is at the slight depression which runs transversely across the middle of the third sacral vertebra, and whose anterior touches the upper edge of the symphysis, between the two pubic tubercles (*c*, *d*, fig. 11);

it forms with the horizontal an angle of 30° (z). Its posterior end is the most unvarying spot of the sacrum, the angle z is fairly constant, and the variations of the angle formed by the normal conjugate and C. v., are just as great as the variations of the angle between the horizon and the C. v., which proves the constant position of the normal conjugate.

The *inclination of the pelvic outlet* is, as already stated, very variable. Its antero-posterior diameter may coincide with a horizontal line; indeed it always does so during parturition, when the fœtal head forces the point of the coccyx backwards; the latter may lie as much as 2 cm. (·75 in.) below the inferior border of the pubic synchondrosis.

Lastly, it must be pointed out, that the degree of pelvic inclination in any individual may be greatly altered by a change in posture, and this circumstance can be made use of in the management of labour. The plane of the inlet is horizontal, when the woman lies with her body a little lower than half-way between sitting and lying.

§ 24. The inner surfaces of the pelvic canal are not parallel to each other; such is at best only true of the surface of the two first sacral vertebræ, which passes backwards and downwards, and of the posterior surface of the symphysis (considered as a straight line) and bodies of the pubic bones, which latter form with the C. v. an angle of about 100°. The lower portion of the sacrum, on the contrary, is directed downwards for a short distance, then curves a little forwards, to which direction the internal surfaces and edges of the pillars of the pubic arch incline more or less. These "*oblique surfaces*" have some influence over the movements which the head undergoes during its passage through the pelvis, though from this point of view the lateral surfaces, which especially in their posterior portions converge below, must be of far greater importance—plana inclinata ossium ischiorum (fig. 12). Their relations are to be found amongst the measurements given above of the transverse diameter at the various levels.

The Axis of he Pelvis.

§ 25. It is difficult to define the *direction* which the pelvic cavity, so irregular in shape and bounded by parietes facing such different ways, has in regard to the horizon. A *middle line* is obtained, by imagining the middle points of the antero-posterior diameters of the different regions of the pelvis connected with one another, although it is not an exact middle line in a mathematical sense, since lines drawn in an oblique direction through the centres of the planes of those diameters are not divided into equal halves by it. The middle line constructed in the way indicated, is called the *pelvic axis*. It is straight in the upper half of the pelvis, córresponding to the approximately straight course of the sacrum as far as the third vertebra, and is perpendicular to the plane of the inlet (fig. 11); from there to the point of the sacrum it curves slightly forwards, corresponding to the direction of the posterior pelvic wall; below the point of the sacrum its direction is no longer constant, owing to the mobility of the coccyx.

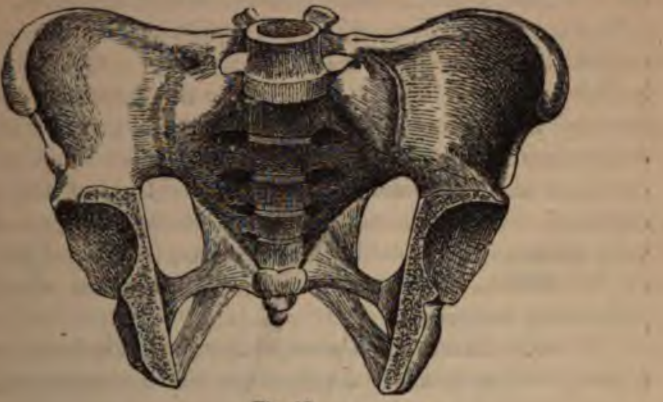

Fig. 12.

If the position of this line is defined in relation to objects lying outside the pelvis, as for instance to the horizon, it gives us a good *axis line* of the pelvis, but it must never be confused with the line which the head, or a point representing its mass, traces in the pelvis during labour, and therefore from that point of view it does not deserve the name of "axis of propulsion."

Development of the Shape of the Pelvis.

§ 26. The shape which has been described, and the relative dimensions which have been given, do not belong to the pelvis at the time of birth. In the pelvis of a new-born child sexual differences are indeed not altogether wanting; the brim is already wider transversely in the female than in the male, but the various distinctions are not so accentuated as in the adult pelvis. The infantile *sacrum* has smaller alæ in comparison to the width of the vertebræ; its anterior surface is more concave transversely; the curve in the direction of its length and that of the coccyx is distinct, though less decided than later; the bone appears less pushed forward between the iliacs and is less inclined forwards. The *bodies of the iliac bones* rise up more at right angles to the horizon, and are almost straight from before backwards, the crests showing only a faint S-shaped curve; Sp. Il. and Cr. Il. present but a slight difference, if any, to the advantage of the Cr. Il.; they frequently both measure exactly the same.

The *lateral walls* converge more rapidly below; the *horizontal rami* of the pubic bones are relatively short; the angle formed by the *pubic arch* is acute. Owing to the sacrum being placed far back and having a less inclination, the C. v. is longer in comparison to the other diameters of the inlet, sometimes even equal to the transverse; the same is true of the oblique diameters. In the pelvic cavity, the antero-posterior and transverse diameters are smaller in comparison to those of the inlet; at the outlet, the smallness of the transverse diameter is particularly noticeable.

§ 27. The forces which convert this infantile into a sexually mature pelvis, are mainly the developmental forces inherent in the several parts of the pelvis, and the pressure of the body-weight.

The various parts of the pelvis do not all grow in the same proportion after birth. The sacrum in the female increases especially in width, and indeed the alæ do so more than the bodies of the vertebræ; the limbs of the lower half of the pelvic ring (pubic bones) increase more rapidly in length than those of the upper half of the ring. Hence the pelvis soon becomes more roomy, and inasmuch as every part now grows more rapidly in the female than in the male, the increased capacity in the former is very obvious. On the other hand the depth of the lateral walls of the small pelvis, and the length of the sacrum do not increase in the female to the same degree as in the male; the pelvis of the former is therefore less deep. That the female generative organs do not assist in bringing about the great increase in the width of the pelvis is self-evident.

§ 28. The *pressure of the body-weight* is a very important factor, and begins to operate as soon as the growing child is able to stand upright.

From a mechanical point of view, the pelvic ring may be divided into an upper (posterior) and a lower (anterior) half, separated from each other by the axis of rotation which passes through the central points of the acetabula. The upper half-ring is completed in its middle by the sacrum, which has the shape of a double wedge; it is wedge-shaped from above and in front, downwards and backwards, as well as from below and in front, upwards and backwards, and is inserted between the lateral limbs. In front these lateral limbs unite with the lower half-ring, which forms a kind of counter-arch. The weight of the body is transmitted by the vertebral column, and falls in the line of gravity on the upper surface of the sacrum; since however the latter is inclined forwards, the force is resolved into two component forces, of which one (the normal) is directed perpendicularly to the upper surface of the sacrum, while the other (the tangent) acts parallel to it. The vertical pressure tends to drive the sacral wedge further down between the iliac bones, but no yielding in this direction is permitted, owing to the disposition and the wedge-shape of the bones. As a result of this pressure however the substance of the wedge is compressed, causing the sacrum to become wider, its vertebræ to be driven somewhat forwards between the alæ, and the transverse curvature of its anterior surface to be diminished.

§ 29. Owing to the fact that the line of gravity of the body falls in front of its points of support, the tangential force acting parallel to the upper border of the sacrum, would drive this bone forwards between the iliacs, and the shape of the sacrum would allow it to glide in this direction, were it not that the ligaments suspending it from the iliac bones become tense, and prevent any further descent. In consequence of this tension the posterior portion of the iliac bones are approximated, and the sacrum is jammed in between them at some point or other. This point forms a fulcrum, just as did the spot at which the above-mentioned widening of the sacrum fixed it more firmly against the lateral walls, round which the pressure from above tends to rotate the sacrum forwards, so as to make it more horizontal. The tense condition of the great and small sacro-sciatic ligaments produced by this movement, resists the displacement of the lower half of the sacrum backwards and upwards, which would otherwise take place, and increases the angle between it and the upper half. At the same time the weight of the trunk presses more heavily on the posterior portions of the bodies of the vertebræ; hence the depth of the upper ones diminishes gradually from before backwards.

As regards the innominate bones, the traction on the posterior ilio-sacral ligaments (which become more and more tense with the displacement forwards of the sacrum) causes a rotation to take place round a vertical axis passing through the heads of the femoral bones, by means of which the posterior extremities of the innominates are approximated, their anterior rendered more divergent at the symphysis pubis, the whole pelvis and especially the anterior lower half of the arch is stretched transversely, and the bodies of the iliac bones open more in front.

The effect of the forces acting on the sacrum—to which must be added the action of the iliacus and psoas muscles which flex the vertebral column towards the extremities, and thereby force the sacrum towards the cavity of the pelvis—is such, that the sacrum approaches the anterior pelvic wall, the transverse diameters become wider, the anterior pelvic wall is flattened, and the anterior extremities of the innominate bones are everted.

§ 30. I have dealt somewhat fully with the influences which give the pelvis its final shape, since a knowledge of them assists us in understanding the mode of development of the pathological varieties. The fact that the alterations in shape thus brought about in the pelvis of the girl, exceed those occurring in the boy, is due to an inherited predisposition, and probably also to the slower progress of ossification in the former.

Differences due to Sex and Race.

The *female* pelvis, looked at as a whole, is distinguished from the *male* by the bones being more delicate, by its width being greater, its depth smaller. The iliac bones are flatter and diverge more in front. The promontory projects less; the sacrum is shorter, and, owing to the increased size of the alæ, broader; its lower half forms a greater angle with the upper. The pubic arch is wider and more rounded, its pillars are somewhat excavated and their inner surface looks forwards; the tuberosities as well as the acetabula are at a greater distance from each other. Various diameters are increased, but the transverse at the inlet is particularly so, in comparison to the C. v. The size of the cavity diminishes less on approaching the outlet, so that the lower aperture is both absolutely and relatively wider.

§ 31. Lastly, it must be pointed out that various *individual* divergences from the described typical form of pelvis are met with, although they scarcely deserve to be called pathological. They occur chiefly at the inlet, and affect the relation of the antero-posterior to the transverse diameter; they must in large part be referred to differences in the primitive conformation, which may disappear or be increased according to the action of the forces coming into operation after birth. In addition to the already described normal form of brim (*i.e.* the outline of an obtuse ace of hearts), there is also met with, first, a shape which is strongly *elliptical in a transverse direction*, and in which the transverse diameter is considerably greater than the others; secondly, a shape which is *elliptical in the antero-posterior direction*, and in which the sagittal diameter measures more than the others; and thirdly, a *rounded shape* which is approximately circular, and is not uncommonly met with in very roomy pelves.

All these varieties occur in every branch of the human family, and the differences found in various *races* depend, for the most part, merely on the varying relation of the antero-posterior to the transverse diameter. The latter however is the greater in the normal pelvis of every race. European women have the most roomy pelves, and the size of the transverse diameter of their great and of the brim of their small pelvis is especially noticeable. The American pelves are also very beautifully constructed, and the same is said to be true of the Chinese, whose pelves are almost indistinguishable from the European. The Negro pelvis on the other hand is small, rather inclined to be circular, and has a narrow pubic arch. That of the Caffres is graceful, with but slight differences between the two sexes. The smallest pelvis of all is found among the Hottentots and Bushwomen; it is more or less dwarfed. The Australian pelvis is small and light, with long conjugates, but distinct sexual differences. The pelvis of the Malays has a rounded inlet, a straightened sacrum, large iliac fossæ and a wide pubic arch. The view that the further North a race of people lives, the wider does its pelvis become, and that a similar change is associated with the increasing civilisation of a race, is not proven. It is more likely to be true that favourable conditions as regards nutrition and occupation are the factors, which lead to a well constructed pelvis in a race.

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3. *The Pelvis with its Soft Parts.—The Parturient Canal.*

§ 32. In order to get a just conception of the pelvis as a parturient canal, as well as to understand many and especially pathological puerperal events, it is necessary briefly to consider the soft parts which line the cavity of the pelvis, fill up the gaps, and cover and smooth over the often sharp projections, and to describe the connections of the genital canal with its neighbouring organs.

In the *great pelvis* (*cf.* § 13) the iliacus internus muscle covers the internal surface of the iliac bone, and fills up its concavity. The space between the lumbar vertebræ and the ilium, as well as that above the lateral region of the pelvic inlet, are occupied by the psoas major, and as these two muscles, in conjunction with the great vessels lying on their inner side (common and external iliacs), pass down on either side to the upper part of the thigh, they so alter the form of the inlet, that it comes to resemble a triangle with its blunted apex turned backwards, while the transverse diameter is somewhat shortened.

In the *pelvic canal* the symphysis and the middle of the sacrum and coccyx are free from muscles; the remaining portion of the anterior and posterior wall, as well as the lateral walls are covered by the internal obturators and the origins of the pyriformes. These muscles with their covering of thin pelvic fascia, narrow the pelvic cavity at its sides by several millimetres, while acting in the same way in an antero-posterior direction, are the walls of the bladder, the urethra, the vagina, the rectum and the cellular tissue connecting these organs.

§ 33. The principal alteration effected by soft parts takes place at the *pelvic outlet*. Strong muscles and fasciæ—pierced only by the rectum, vagina and the neck of the bladder, closely connected with them and so holding them *in situ*—here form a floor, which bears the weight of the abdominal viscera, and acts powerfully in a direction opposed to the weight of these organs. The firmest portion of this floor is formed by the levatores ani muscles, which are lined on their upper surface by the pelvic fascia, on their lower by the perinæal fascia, and which constitute the *diaphragm of the pelvis*. The fibres of these muscles arise for the most part from a line stretching on each side from the pubic arch to the ischial spine; they converge behind, and unite in the middle line of the body, blending in part with those of the other side. The posterior fibres, closely connected with the sacro-sciatic ligament, diverge and run from the ischial spines to the lateral border of the coccyx (usually called M. coccygeus).

Beneath this partition, between the anus and the external generative organs, lies the *perinæum;* it rarely measures more than 3 cm. (1·2 in.) from before backwards, while its greatest breadth corresponds with the distance between the ischial tuberosities. In the perinæum, especially in the space which lies between the ischial and pubic bones, the anus and the external genitals, are situated the muscles belonging to these organs. Seen from below (fig. 13), the *sphincter ani externus* lies furthest back and very superficially (6); between it and the lateral wall of the pelvis, bounded above and internally by the levator ani, which is descending towards the middle line, covered below by skin and superficial fascia, is the tent-shaped *ischio-rectal fossa*, which becomes narrowed above and is filled by a considerable pad of fat. The superficial transversi perinæi muscles, running forwards and in an oblique direction, pass through the anterior portion of this fossa; in front of them and near to the ascending ischial rami lie the ischio-cavernosi muscles (9); beside them, immediately next the middle line, is the constrictor vaginæ (5); deeper down, between the ischio-cavernosi muscles and the constrictor vaginæ, appear the transversi perinæi deep muscles (4).

§ 34. These layers of muscles are separated from each other and strengthened by various fasciæ. That lining the pelvic cavity (*pelvic fascia*) covers, as already mentioned, the upper surface of the muscular diaphragm of the pelvis, and becoming reflected upwards, blends with the connective tissue covering of the viscera which pass through it. The under surface of this diaphragm is lined by the *perinæal fascia*. In the region of the anus, this fascia is reflected downwards at an acute angle from the origin of the levator ani to the inner surface of the ischium, and terminates at the tuberosity, thus lining the ischio-rectal fossa; in the front half of the pelvic outlet, it splits into two layers, which embrace the muscles lying beneath the pelvic diaphragm. The *deep* layer is spread out in the space between the ischio-cavernosi and the constrictor vaginæ muscles, *i.e.* between the crura of the clitoris, stretches above the vestibulum to the lower edge of the symphysis, lines the upper surface of the deep transversi perinæi muscles, encloses the urethra and passes into the middle pubo-vesical ligament. The *superficial* layer winds round the superficial transversi perinæi muscles, lines the ischio-cavernosi, the constrictor vaginæ, and the under surface of the deep transversi perinæi muscles, and then merges into the fascia of the clitoris.

The connective tissue between the external skin and the perinæal fascia is well supplied with fat, and at the circumference of the sphincter ani externus becomes thickened, so as to form a fascialike membrane, blending with the proper perinæal connective tissue—*subcutaneous perinæal fascia*.

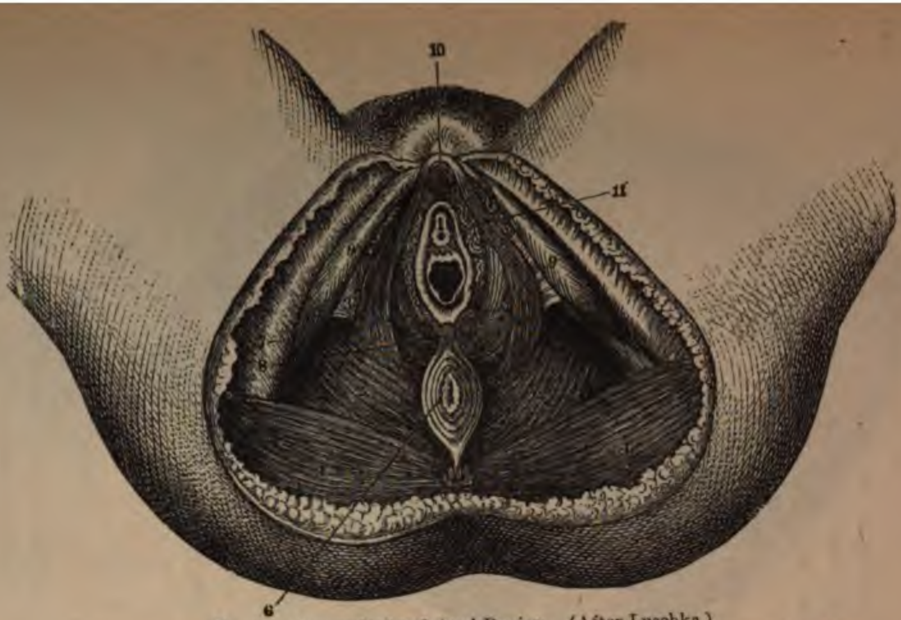

Fig. 13.—Uro-genital and Anal Region. (After Luschka.)

1. Gluteus maximus.
2. Levator ani.
3. Superficial transversus perinæi.
4. Deep transversus perinæi.
5. Constrictor vaginæ.
6. External sphincter ani.
7. Bands of muscle passing from it to the constrictor vaginæ.
8. Bands passing to the posterior commissure of the labia.
9. Ischio-cavernosus.
10. Clitoris.
11. Bulbus vestibuli.

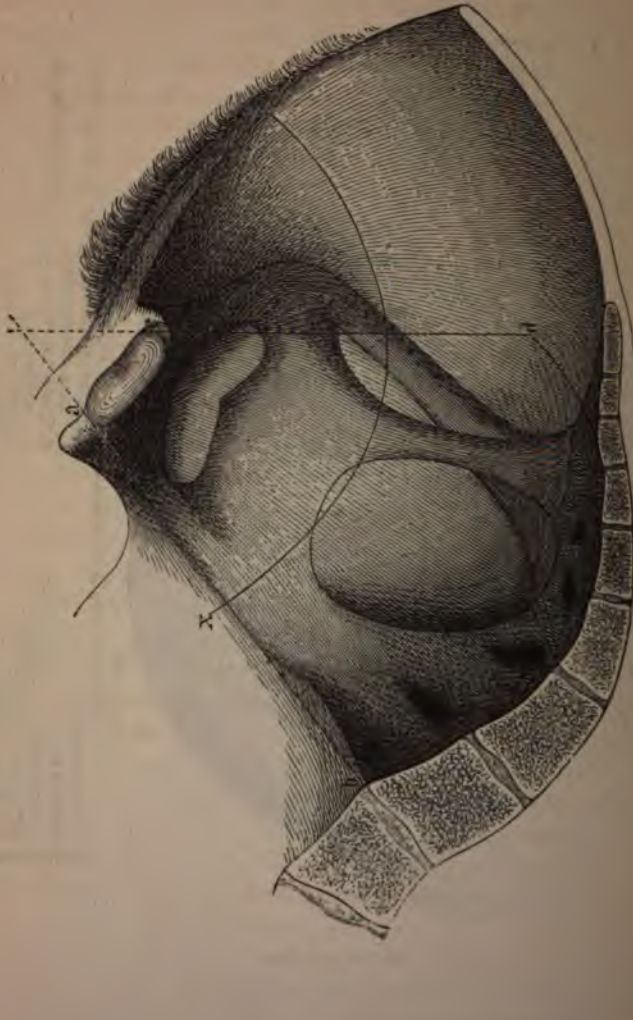

Fig. 14.—The Parturient Canal. (After Hodge.)

The transverse perinæal septum is of great strength in woman, and on both sides of the posterior commissure of the labia, forms a hard ill defined body composed of connective tissue and elastic fibres and of interlacing bundles of unstriped muscle, and traversed by large blood-vessels. The various voluntary muscles of the perinæal region meet in this body, and become more or less blended.

§ 35. The addition of the pelvic floor increases the length and the curvature of the pelvic canal; it now appears closed below except for one opening, which is not at the central point of the pelvic outlet, but at its anterior portion.

The axis of this opening cuts the middle line of the bony canal at an angle opening in front, and meets the sacrum in its upper half. During labour under the pressure of the advancing child, it is mainly the soft parts lying behind the opening that are stretched, and thus is produced a deep channel or furrow, opening into the enormously distended vulva, and finally forming a continuation of the middle line (x) of the bony pelvis (fig. 14).

§ 36. The *roof of the pelvic cavity* is formed by the peritoneum (*cf.* §§ 9 and 10), which stretches between the symphysis and the middle of the first sacral vertebra, on a level with the ilio-pectineal crest and the ilio-sacral synchondrosis, and which I have named diaphragma mobile. It lines the organs lying in the brim of the pelvis, is pushed up by them, and is reflected from one to another in an antero-posterior direction, forming pouches and folds; the most important of these is the middle one which lies transversely, and is destined for the reception of the internal generative organs. I will first describe these organs, and then their serous membrane.

The Sexual Apparatus.

§ 37. The sexual apparatus forms a single canal, which divides internally into right and left branches, these branches passing off nearly at right angles (Henle) to the first-mentioned single canal. The latter (figs. 15 and 16) may be divided into three portions, lying one above the other. The *lower* corresponds to the uro-genital sinus, and includes the space known as the *vestibulum* and the *external genital organs*—labia majora, corpora cavernosa of the urethra and clitoris with the mucous folds of the latter, clitoris, nymphæ, urethral orifice and Cowper's glands.

The *middle* division is the *vagina*—a thick-walled tube, beginning at the posterior end of the vestibule, and having the same relation to the latter, as the leg of a boot has to the foot portion without the sole (Henle). The canal ascends obliquely at first, and then curves round so as to ascend vertically (the convexity being directed downwards), and at its anterior wall the boundary between the vagina and the vestibule is indicated by the urethral orifice. From the opposite side of the vagina, and defining its posterior wall, springs a horizontal mucous fold—the *hymen*. The transverse fissure with a forward concavity, placed between the hymen and the urethral aperture is the *vaginal orifice*, which after the destruction of the hymen becomes funnel-shaped.

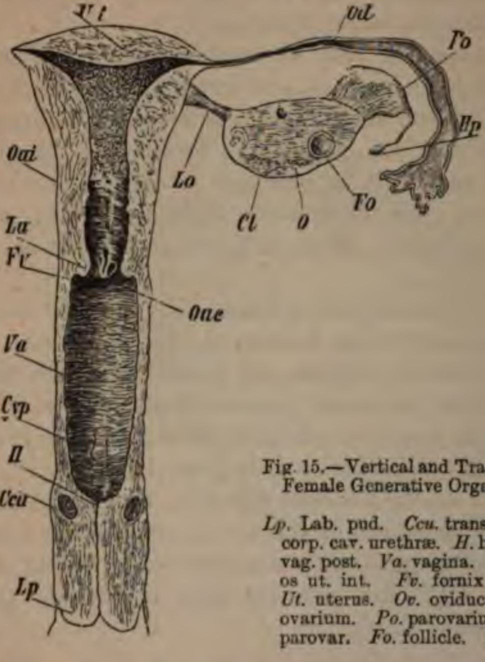

Fig. 15.—Vertical and Transverse Section of the Female Generative Organs. (After Henle.)

Lp. Lab. pud. *Ccu*. transverse section through corp. cav. urethræ. *H*. hymen. *Cvp*. columnæ vag. post. *Va*. vagina. *Oue*. os ut. ext. *Oui*. os ut. int. *Fv*. fornix vag. *Lu*. lab. uter. *Ut*. uterus. *Ov*. oviduct. *Lo*. lig. ovar. *O*. ovarium. *Po*. parovarium. *Hp*. hydat. of the parovar. *Fo*. follicle. *Cl*. corpus luteum.

§ 38. The *uterus* is joined on to the vagina as an upper division, and forms a muscular reservoir, which is hour-glass in shape, narrowed below, flattened from before backwards, and has a comparatively small lumen. The latter communicates with the cavity of the vagina by a transverse fissure (orificium uteri externum), which when intact is lined by a delicate fringe of mucous membrane. The orifice lies between two lips (*labia oris uteri*) which project in the form of tubercles into the vagina, and practically close it above. They lie however more in the line of its anterior than of its posterior wall, in consequence of which the anterior lip is lower than the posterior; the axis of the uterine cavity forms an obtuse angle with the vaginal canal, and the anterior vaginal wall is separated from the anterior lip of the os uteri merely by a shallow groove, while the mucous membrane from the posterior wall of the vagina is reflected downwards at an acute angle, in order to be continued on to the posterior lip of the cervix. The groove which is formed round the lips of the os by the reflection of the vaginal mucous membrane on to those lips is called the *fornix vaginæ;* the part of the uterine neck which bears the tubercles surrounding the os, which is enclosed by the fornix and which projects into the vagina, is the *portio vaginalis*. The constriction which gives the uterus its hourglass shape, indicates the situation of the internal os or boundary between neck and body, which two regions moreover are distinguishable by the surface of the mucous membrane, which is thrown into rugæ over the former, smooth over the latter.

§ 39. The length of the *vagina, i.e.* of its posterior wall is about 7 cm. (2·75 in.), the anterior being 1·5—2 cm. (·6—·8 in.) shorter. Its distensibility is well known; in its closed condition the walls are in contact, and the lumen appears on transverse section as little more than a transverse fissure, showing however a different outline and various peculiarities according to the region of the vagina under observation. Its usual shape is that of an H, the transverse limb being slightly curved forwards or backwards, and about 2·5 cm. (1 in.) long; the lateral limbs of the H are somewhat convex towards the median line or else interrupted, with the middle of the curve reaching to the transverse limb. In this way the vagina accommodates itself to the condition of neighbouring organs; very often indeed the fissure is unsymmetrically bent, projections of one wall corresponding to depressions of the other.

The *uterus*, which has been described above as hourglass-shaped, is in the virgin condition constricted exactly at the middle of its length. Above this point the organ increases continually in width (*body of the uterus*), while the cervical portion grows narrower towards its lower end. Hence the organ becomes pyriform, or similar to an inverted nine-pin, a resemblance which is even more distinct after repeated labours, owing to the fact that the weight of the upper portion becomes greater as compared with that of the lower, and that the constriction comes to lie below the middle point. The posterior surface is convex transversely, the anterior flattened; the edges are rounded off, the lateral surfaces indistinctly marked off from those adjoining them; the upper surface is slightly convex upwards and sharper. After pregnancy the surfaces retain a greater convexity and the edges become blunter; the boundary between the upper and the lateral edges is then indicated by the insertion of the oviducts and round ligaments. The portion above these is termed the *fundus uteri*.

In nulliparæ the uterus is smaller than in women who have borne children. The length from the fundus to the anterior lip amounts to 7—8 cm. (2·75—3·15 in.), the width at the fundus to 3·5—5 cm. (1·25—2 in.), at the boundary between body and cervix to 2—2·5 cm. (·8—1 in.); the depth immediately below the fundus is 2—3 cm. (·8—1·2 in.). The cervix is 3—3·5 cm. (1·2—1·4 in.) long, 2·5 (1 in.) wide, and 1·5—2 cm. (·6—·8 in.) deep. The anterior lip as a rule projects 5—7 mm. (·2—·3 in.) beyond the os, the posterior measures from the fornix to its free edge about 1·8 cm. (·7 in.). The walls are 1—1·5 cm. (·4—·6 in.) thick in virgins, but 2 cm. (·8 in.) in women who have had children (Henle). According to Krause, the weight in virgins averages 34—41 grammes (1·1—1·3 oz.), in fruitful women 104—120 grm. (3·3—4 oz.).

§ 40. The *position* of the uterus varies greatly with the condition and degree of repletion of the neighbouring organs, and with the attitude of the body. Under ordinary circumstances it lies entirely in the pelvis, with its fundus directed forwards behind the upper portion of the anterior pelvic wall. In the erect position this forward inclination is increased, owing probably to the weight of the organ which compels the fundus to descend, the internal abdominal pressure contributing in a less degree. The uterus is not only inclined forwards, but almost always towards the right side also, while the left is rotated forwards, a position caused mainly by pressure of the rectum during development, and by the weight of the organ in the right lateral posture, which is the commoner. (Dohrn ascribes it to the pressure exerted by the rectum, which lies on the left side.) Moreover the organ is curved forwards, particularly in children and quite young persons; the body forms with the cervix an obtuse angle open anteriorly, while the portio vaginalis on the other hand is displaced slightly in the opposite direction, giving the cavity a curve somewhat like that of a flattened S. The cavity itself is a fissure, lying between the anterior and posterior walls, which are in contact with each other, and above and at the sides unite along a line which is nearly parallel with the external outline of the uterus. The cavity is therefore linear in an antero-posterior and transverse section, but triangular in a bilateral section through the body, the triangle having sides that bulge inwards (they are concave only in multiparæ), and a blunt apex with the point directed downwards; this cavity is continuous with the cervical canal, which has the shape of an elongated quadrangle, of which the sides are bulging with a concavity directed inwards; the upper lateral corners of the uterine cavity open into the canals of the oviducts. The internal surface of the body of the uterus is smooth; that of the cervical portion has numerous transverse rugæ. The opposed rugæ however do not always fit accurately into one another, so that the section of the cervical canal has often the appearance of a clear lumen; it is more frequently filled by secretion than is the body.

§ 41. The double portion of the sexual apparatus begins at the upper angle of the body of the uterus with the *oviduct* or *Fallopian tube*, an arched cylindrical canal 10—16 cm. (4—6·25 in.) long, which passes downwards, outwards and backwards by the side of the uterus. Near its external extremity which is turned towards the ovary, it widens and has a funnel-shaped opening into the abdominal cavity. The middle thin and narrow portion is called the *isthmus*, the external sinuous and wider portion the *ampulla;* the first has a transverse diameter of 2—3 mm. (ca. ·1 in.), the latter of 6—8 mm. (·25—·3 in.) and more. The funnel, or *infundibulum*, which surrounds the opening, is divided by clefts into numerous processes (*fimbriæ*), of which one is specially long and jagged, and serves to fix the infundibulum to the outer end of the ovary (f. ovarica). The Fallopian tube is the efferent duct of the *ovary*, and is as a rule only periodically applied to it in order to take up its products. The ovary lies beneath the oviduct, between its abdominal aperture and the posterior margin of the side of the uterus, and is attached to the latter by a short ligament—*lig. ovarii* (fig. 15). In the horizontal posture, the tube lies behind and above the ovary, and thus forms a *bursa ovarica*, which is of importance for the reception of the ovum.

The uterus and oviducts together raise the bottom of the pouch of peritoneum which projects into the pelvic cavity, to form the transverse fold (*cf.* § 36) which passes from one side of the pelvis to the other; this fold lines the uterus in its middle portion, is reflected in front on to the bladder, behind on to the rectum, and on either side forms the *broad ligament*. This fold also encloses the vessels passing to the uterus and ovary, and the *parovarium*, which occupies the angle between the last bend of the oviduct, the fimbria ovarica and the outer end of the ovary, and consists of remains of the primordial kidneys; the small canals of which it is composed, converge towards the lower edge of the ovary.

The Pelvic Peritoneum.

§ 42. The peculiar arrangement of the pelvic serous membrane is important from a practical point of view, and will now be described:—

The peritoneum leaves the uterus on four sides: on the anterior surface it reaches to the level of the internal os, sometimes a little lower, and then (supposing the bladder to be moderately distended) is reflected at a somewhat acute angle (fig. 16) on to the posterior wall and base of the bladder, and from there on to the anterior abdominal wall. The anterior surface of the cervix is in immediate contact with the bladder, and connected with it by a thin layer of loose cellular tissue, by muscular fibres (derived from both organs) and venous plexus. The peritoneal pouch formed in this way between the uterus and the bladder—*utero-vesical pouch*—is bounded laterally by the slightly prominent and gently curved *utero-vesical folds*, in which run a few strands of muscle fibres derived from the uterus. The peritoneum descends further on the posterior surface of the uterus than it does in front, but is closely connected with it only as far as the level of its reflection in front; below that level a layer of loose cellular and numerous veins intervene between the cervix and the peritoneum. The latter next descends over the entire posterior surface of the cervix,

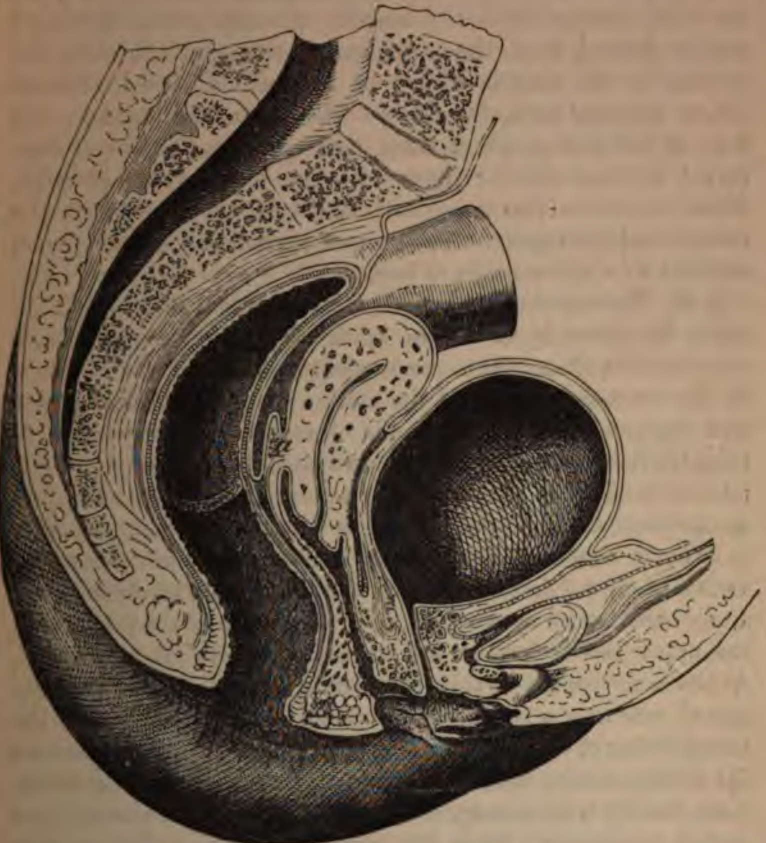

Fig. 16.—Median Section through the Female Pelvis, left half. (After Kohlrausch.)

covers in addition a portion of the vaginal fornix for a distance of 1—2 cm. (·4—·8 in.), and is then reflected (at a more obtuse angle than on the anterior surface) backwards on to the rectum, at a point about 6 cm. (2·25 in.) above the anal orifice; thus is formed the deep *recto-uterine* or *Douglas' pouch.*

This pouch also is bounded laterally by curved folds, the *recto-uterine* or *semilunar folds of Douglas*, which however are not always equally distinct; behind they pass into the sides of the rectum, but on the posterior surface of the cervix they meet and form a transverse projection with a concavity looking backwards (fig. 16, *a*). These folds of Douglas, especially at their free edge, contain bundles of smooth muscular fibres, which are mainly derived from the uterus and vagina, and run along the rectum to the neighbourhood of the second sacral vertebra (Musc. retractor uteri, Luschka). The peritoneum forming the floor of Douglas' pouch is thick, rich in elastic fibres, and connected by loose cellular tissue with the dense plexus of veins, which surrounds the uterus and makes its way in between the rectum and the vagina. The deepest portion of Douglas' pouch contains as a rule no coils of intestine.

§ 43. The anterior and the posterior layers of the fold in which the uterus is, as it were, taken up, do not come quite into contact at its sides; there remains between them a sort of hilum for the entrance and exit of the uterine vessels, which are at this spot surrounded by strong bands of muscle. After uniting to form the *ligamentum latum*, these two layers pass on as peripheral folds to the sides of the pelvis, the posterior fold always extending deeper than the anterior. The line along which they separate in order to be reflected forwards and backwards on to the internal surface of the pelvic wall, is continued down along the hypogastric artery; the lateral extremity of the free margin of the fold lies in the upper pelvis close to the iliac artery above its bifurcation. At the lower border of this free edge, the two lamellæ gradually spread out into a single layer, which is continuous with the serous lining of the iliac fossa. The free edge of the fold encloses the Fallopian tube, and, corresponding with the course of the latter, runs directly transversely, and further outwards is sinuous and curved backwards. Since the opening of the Fallopian tube pierces the peritoneum on the proximal side of the lateral attachment of the ligamentum latum, a terminal lateral portion of the fold is left, which is empty and sharp, and measures about 2 cm. (·8 in.) in length between the infundibulum and the pelvis; this is the *infundibulo-pelvic ligament*. The orifice of the oviduct lies in the posterior layer of the broad ligament immediately below its free edge, the abdominal orifice of the tube thus being directed towards the median line and at the same time backwards.

From the posterior surface of the broad ligament rises a secondary fold for the reception of the lower portion of the ovary; it is placed obliquely and forms with the broad ligament a pouch, whose opening looks upwards. The portion which is thus spread out between the Fallopian tube and the ovary incl. its muscular ligament, is the *ala vespertilionis*. It contains the *parovarium* and numerous vessels, and is bounded laterally by a smooth curved edge to which the fimbria ovarica with its serous surface is attached—*infundibulo-ovarian ligament* (Henle).

§ 44. The *round ligament* of the uterus is enclosed in a prominent longitudinal fold of the anterior layer of the broad ligament, and consists of a flattened cord 5—7 mm. (·2—·3 in.) wide, composed of the superficial fibres from the anterior surface of the uterus, which have run together. It appears at the point at which the uterus passes into the oviduct, and forms an acute angle with the latter, as it leaves the uterus. It is covered throughout by peritoneum, runs downwards, forwards and outwards towards the abdominal wall, and passes horizontally along the inner surface of the latter towards the middle line to the internal inguinal ring, its lower end becoming less intimately connected with the peritoneum. Like the spermatic cord in the male, it passes through the abdominal wall and out by the external inguinal ring, and ends in the pad of fat forming the mons Veneris and in the labium majus. As would be expected from its origin, the ligamentum rotundum contains in its upper third smooth muscular fibres derived from the uterus, which usually run along its upper border, but only exceptionally extend as far as the middle third; a number of thin strands from the deep abdominal muscles unite with its lower half and occasionally reach almost to the uterus. All these run along the upper edge of the ligament, and become more and more numerous in a downward and outward direction, and at the internal inguinal ring pass in an arched manner to the transversus abdominis muscle. Occasionally some reach even into the inguinal ring, and then curve round upwards or downwards; in the ligament itself they are accompanied by somewhat large tortuous veins. Now and then the round ligament is accompanied for some distance from the internal inguinal ring between the abdominal muscles, by a narrow process of peritoneum—processus vaginalis peritonei or canal of Nuck. So long as the uterus lies in the small pelvis, the round ligaments must rise above the ilio-pectineal line and take a curved course up to the inguinal canal, while during pregnancy they will descend obliquely outwards to reach the ring; but in any case before entering it, they cross the origin of the epigastric artery.

The two layers of the broad ligament diverge more and more as they descend; the posterior passes by the side of the rectum into the posterior wall of the peritoneal cavity, forming on its inner side the lateral wall of the fold of Douglas, and passing away over the hypogastric vessels and ureter; the anterior ascends from its lower end by the side of the bladder to the anterior abdominal wall, its connection with the round ligament, as already stated, growing gradually looser.

A layer of cellular tissue intervenes between the two layers of the broad ligament, becoming more and more abundant below and at the edge of the uterus; in it run the blood- and lymph-vessels, as well as the nerves which supply the uterus and its appendages; the lower portion also contains numerous plain muscular fibres derived from the superficial layer of the uterus, which radiate in a transverse direction and form a net-work enclosing the vessels. Hence the broad ligaments may be spoken of as the *mesentery* of the *internal generative organs.*

Urinary Passages, Rectum, Pelvic Connective Tissue.

§ 45. In order to complete the topography of the pelvic cavity, a description of the efferent urinary passages, of the rectum and of the so-called parametrium is necessary.

The *urethral orifice* is usually vertical, oblong, 5 mm. (·2 in.) in length and situated between the nymphæ above the entrance of the vagina; in married women, and especially after frequent coitus with a narrow vagina, the opening often lies far back, even behind the symphysis, so that to bring it into view, it must be drawn forwards per vaginam; it is surrounded by a frequently uneven wall of mucous membrane. The canal itself runs between the corpora cavernosa of the clitoris, beneath the lig. arcuatum inferius, in front of the median line of the lower division of the vagina with which its wall is very closely connected (*urethro-vaginal septum*), and has an almost straight direction from below and a little in front, upwards and backwards to the bladder; only at the opening into the bladder is there a slight curve. The wall of the urethra is highly muscular; the outer muscular layer may form a complete ring, but now and again leaves a gap anteriorly (superiorly); the internal layer runs parallel with the axis of the canal, and its fibres frequently interlace.

The anterior convex surface of the *bladder* lies mainly behind the symphysis, but when the organ is distended, projects above it, and comes into contact with the linea alba of the abdomen; the lower portion is attached by connective tissue and ligaments (*pubo-vesical ligaments*) to the symphysis and pelvic fascia. The upper portion is so loosely connected with the abdominal wall by cellular tissue, that it can glide over it and raise the parietal peritoneum to a height of 3—4 cm. (1—1·5 in.) above the symphysis. The vertex of the bladder is covered by peritoneum; so also is the upper portion of the posterior surface, that namely which looks towards the uterus (vesico-uterine pouch). The portion of the posterior wall which remains uncovered by peritoneum, is loosely connected with the supra-vaginal portion of the cervix by cellular tissue and muscular fibres, but on the other hand is very closely attached to the anterior vaginal wall, by which the base of the bladder is supported, and over the sides of which it occasionally slightly projects. When the bladder contracts during micturition, the peritoneum is drawn further down, so that it comes not only to line the whole supra-vaginal portion of the cervix, but actually encroaches on the laquear vaginæ, this being permitted by the looseness of the subperitoneal areolar tissue. A cordlike process of the superficial muscular layer of the anterior uterine wall becomes connected at the base of the bladder with the fibres of the detrusor urinæ.

The axis of the bladder forms with that of the urethra an angle opening in front, and both axes run nearly parallel to the middle line of the pelvis, though the bladder deviates slightly to the right.

§ 46. The *ureters* measure on an average 26 cm. (10 in.) in length and 5 mm. (·2 in.) in width. Their *abdominal portions*

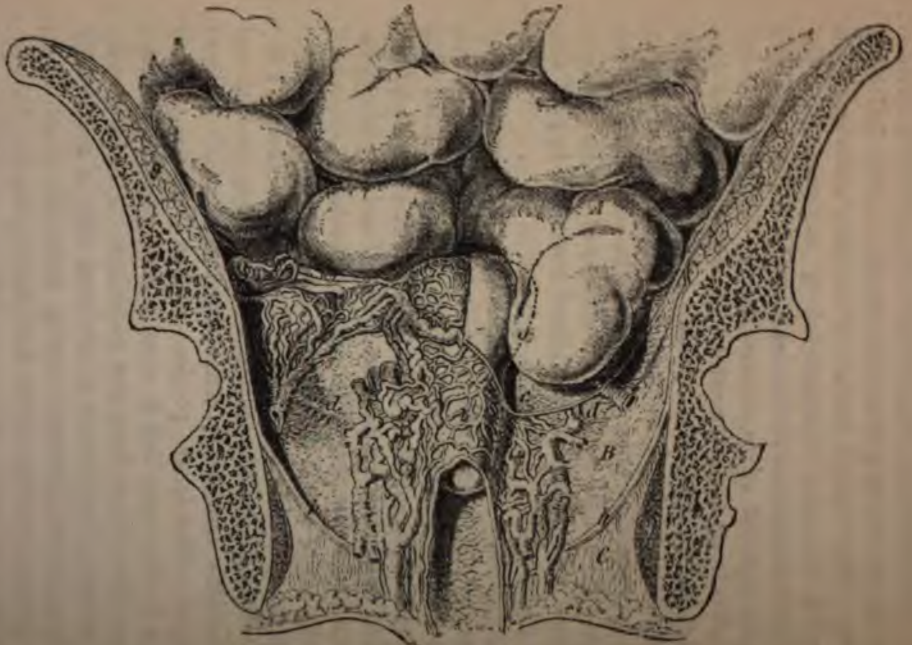

Fig. 17.—Posterior View of the Genital Tract and its Surroundings (semi-diagrammatic).

A, cav. pelv. perit. *B*, cav. subperit. *C*, cav. p. subcutan. *a*, contour of the uterus. *b*, parametric venous plexus in the subserous connective tissue, made visible by the removal of the posterior layer of the ligamenta lata (completely on the left side, partially on the right). *c*, remainder of the posterior layer on the right side. *d*, point of reflection of the anterior layer on to the anterior abdominal wall (seen through). *e*, left ovarian venous plexus. *f*, left Fallopian tube. *g*, iliacus muscle. *h*, pelvic diaphragm.

neath the pelvic roof, extends a layer of connective tissue, ore or less rich in fat, and which in unbroken continuity fills all those interstices between the pelvic organs which lie tween the boundaries of the peritoneum and the levator ani, d which connects these organs with each other. It repre- nts in the main the *subserous connective tissue* of the pelvis, d may be compared to the sub- or retro-peritoneal tissue in her portions of this serous membrane. Since the peritoneum nks to different levels in different parts of the cavity of the elvis, though never quite to the level of the levator ani, the hole pelvic cavity may be divided into a *peritoneal*, and into a *bperitoneal* pelvic cavity. There is however between the nder surface of the diaphragm of the pelvis, and the lateral elvic walls looking towards it, a further interspace which is eepest at the sides and filled by adipose tissue (*cf.* § 33), and hich, since it is closed below by skin, may be called the *sub- taneous* pelvic cavity (*cf.* fig. 17).

Of these three divisions, the subperitoneal cavity (whose ntents surround the portions of the pelvic organs which are ot lined by peritoneum) is of greatest interest from a patho- gical point of view. It not only contains loose adipose cellular ssue, which by its elasticity permits the distention of the ollow organs, and makes it possible for the loose serous mem- rane connected with it to adapt itself to the varying size of hose viscera without tension, but in it lie numerous arteries nd veins, absorbents and lymphatic glands; the enormously eveloped venous plexus also form a very important constituent ig. 18).

The connective tissue of the pelvic cavity is most abundant t the base of the broad ligaments, and at the sides of those ortions of the uterus and vagina which appear to be let into hem, viz. the cervix and the upper half of the vagina. It is his portion which Virchow (*cf.* his *Archives*, No. XXIII.) has alled the *parametrium*; but inasmuch as the loose cellular tissue ncloses the portion of the bladder and of the rectum turned owards it in exactly the same way, it is impossible to assign efinite boundaries to the division called parametrium.

It is more accurate to speak of the contents of the subperitoneal pelvic cavity, as the *subserous connective tissue* of the pelvis, and of that portion which is in immediate proximity with

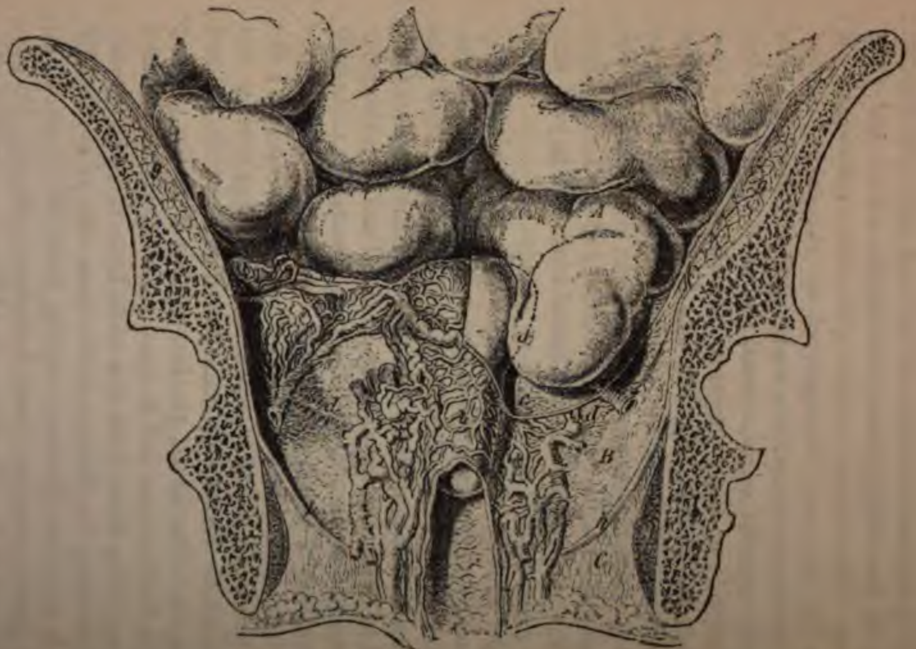

Fig. 17.—Posterior View of the Genital Tract and its Surroundings (semi-diagrammatic).

A, cav. pelv. perit. *B*, cav. subperit. *C*, cav. p. subcutan. *a*, contour of the uterus. *b*, parametric venous plexus in the subserous connective tissue, made visible by the removal of the posterior layer of the ligamenta lata (completely on the left side, partially on the right). *c*, remainder of the posterior layer on the right side. *d*, point of reflection of the anterior layer on to the anterior abdominal wall (seen through). *e*, left ovarian venous plexus. *f*, left Fallopian tube. *g*, iliacus muscle. *h*, pelvic diaphragm.

beneath the pelvic roof, extends a layer of connective tissue, more or less rich in fat, and which in unbroken continuity fills up all those interstices between the pelvic organs which lie between the boundaries of the peritoneum and the levator ani, and which connects these organs with each other. It represents in the main the *subserous connective tissue* of the pelvis, and may be compared to the sub- or retro-peritoneal tissue in other portions of this serous membrane. Since the peritoneum sinks to different levels in different parts of the cavity of the pelvis, though never quite to the level of the levator ani, the whole pelvic cavity may be divided into a *peritoneal*, and into a *subperitoneal* pelvic cavity. There is however between the under surface of the diaphragm of the pelvis, and the lateral pelvic walls looking towards it, a further interspace which is deepest at the sides and filled by adipose tissue (*cf.* § 33), and which, since it is closed below by skin, may be called the *subcutaneous* pelvic cavity (*cf.* fig. 17).

Of these three divisions, the subperitoneal cavity (whose contents surround the portions of the pelvic organs which are not lined by peritoneum) is of greatest interest from a pathological point of view. It not only contains loose adipose cellular tissue, which by its elasticity permits the distention of the hollow organs, and makes it possible for the loose serous membrane connected with it to adapt itself to the varying size of those viscera without tension, but in it lie numerous arteries and veins, absorbents and lymphatic glands; the enormously developed venous plexus also form a very important constituent (fig. 18).

The connective tissue of the pelvic cavity is most abundant at the base of the broad ligaments, and at the sides of those portions of the uterus and vagina which appear to be let into them, viz. the cervix and the upper half of the vagina. It is this portion which Virchow (*cf.* his *Archives*, No. XXIII.) has called the *parametrium;* but inasmuch as the loose cellular tissue encloses the portion of the bladder and of the rectum turned towards it in exactly the same way, it is impossible to assign definite boundaries to the division called parametrium.

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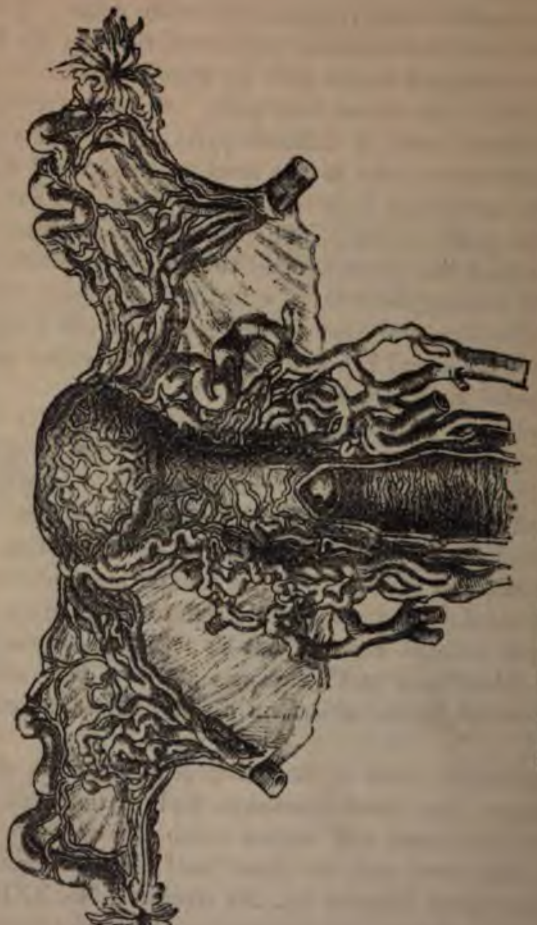

Fig. 18.—Venous Plexus of the Genital Canal. (After Luschka.)

utero-vaginal canal, as parametrium, or better as *parametric connective tissue* (since the word parametrium, like parovarium, involves the conception of a neighbouring organ, which is not appropriate here).

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4. *The Minute Structure of the Generative Organs.*

§ 49. The integuments of the external generative organs are in the main prolongations of the external skin, all the usual layers of which are found on the outer surface of the *labia majora.* The loose areolar tissue beneath the skin contains groups of fat-cells, numerous large blood-vessels and nerve trunks, sweat glands and hair follicles; sebaceous glands also are well developed. Close to the skin, a dense net-work of elastic fibres extends parallel with the surface, and amongst them are scattered smooth muscular fibres (Henle). On the inner surface of the labia the skin becomes thinner and redder, while at the point of reflection upon the *nymphæ* the epidermis is thinner, and the tissues come to resemble those covering the lips of the mouth. The nymphæ with their irregular edges, possess a well formed mucous membrane with a beautiful stratified pavement epithelium and closely set conical, usually single, vascular papillæ; the connective tissue situated between the folds of the nymphæ, is devoid of fat, but is traversed by strong bundles of elastic fibres, and contains some smooth muscular fibres; in the meshes of the reticulum formed by the elastic trabeculæ, run large veins from which a plexus of smaller veins is derived, which plexus appears to be everywhere traversed by a net-work of capillaries. This arrangement gives the nymphæ some resemblance to an erectile tissue. Sebaceous glands without hairs are found on the nymphæ as far as their inner side.

When the mucous membrane which is in direct connection with the nymphæ and with the vestibule, reaches the *clitoris*, it lines the corpora cavernosa and the small glans (forming the prepuce and the frænulum); these structures are connected with the bulbi vestibuli—the split corpus cavernosum urethræ of woman—by a double venous plexus, which runs back from the glans along the lower surface of the clitoris to the vestibule. All these parts are constructed in the female much as they are in the male.

The sides of the *vestibule* are provided with numerous knob-like and filiform projections and papillæ, which are most distinct above and below the urethral opening, and in the fossa navicularis. Between these folds are the orifices of numerous often racemose mucous follicles, lined by a single layer of cylindrical epithelium; only at those orifices is the pavement epithelium of the surface again met with. Two larger but similar glands, called the *glands of Bartholini* (homologous with the glands of Cowper in the male), open one on either side of the vaginal orifice at the lower end of the bulbi vestibuli. They are in close connection with the perinæal muscles, and indeed a few muscular bundles pass in between the glandular acini. Each gland measures 1·5—2 cm. (·6—·8 in.); the duct having an equal length. Its wall, according to Kölliker, contains a delicate longitudinal layer of smooth muscular fibres, and is ·2 mm. (·01 in.) thick; the lumen is 1—3 mm. (·05—·15 in.) wide; the duct, like the acini, is lined with cylindrical epithelium. The secretion of a perfectly healthy gland is a stringy clear thin mucus.

The Vagina.

§ 50. The walls of the *vagina*, 2 mm. thick (·1 in.) consist of an external fibrous or connective tissue coat, which is rich in elastic fibres and venous plexus, of a muscular coat, which is not readily separable from the latter, and of a mucous membrane; near the orifice of the vagina, these three coats are considerably thickened, giving rise to an anterior and posterior median ridge, called the *columna vaginæ anterior* and *posterior* (Henle), or the carina vaginæ (Kohlrausch); at their upper end they diminish in thickness. The *muscularis* contains much connective tissue and a large venous plexus, so that it scarcely looks like a continuous layer of muscle; it is arranged in two strata, an external circular stratum, and an internal which is thicker and longitudinal; oblique bundles of muscular fibres run from one into the other, and interlace as they do so; a few indeed reach the mucous membrane and its papillæ. The *mucous membrane* is well supplied with the latter, and has as its basis a layer of connective tissue, which is rich in elastic fibres and owes its extensibility to them; it is thrown up into numerous folds which on the anterior and posterior walls run mainly transversely (*columna rugarum anterior et posterior*), are hard, rough and dentated at their edge. They are formed by a complex arrangement of broad papillæ, which vary in size and often possess clubbed extremities.

The epithelium is of the squamous variety, and about ·6 mm. (·02 in.) in thickness; no glands are met with, though lymph follicles according to Löwenstein are present. The mucous membrane is well provided with lymphatics and nerves, and Chrschtschonovitsch states that the latter actually reach the epithelium, and form a net-work between the cells. Some of arteries end in a submucous capillary net-work, some reach the papillæ. In the vaginal columns, numerous large veins are found which originate in the papillæ. They are connected in a kind of net-work and with the muscular fibres contained in the columns, give rise to a cavernous tissue; the veins, on entering the submucous tissue, form elongated meshes in the direction of the longitudinal axis, and, after uniting with larger branches, pierce the muscular coat and constitute the plexus venosus vaginalis, in the walls of which the trabecular arrangement of other erectile organs is present.

The fold of mucous membrane which closes the entrance to the vagina, is called the *hymen;* it varies in thickness, and its free edge may be even, or lobed or supplied with papilliform projections. It forms a transverse crescentic fold, with the horns of the crescent turned towards the urethra; or else a circular disk, with an opening which is usually eccentric and nearest to the anterior edge. When the opening is wide and central, the hymen is sometimes reduced to a mere ringlike projection, and can thus give the impression of being absent; in rare cases several openings are present. The hymen is not necessarily torn in coitus, or even during parturition, but even if it retains the form of a membrane, the posterior edge is more or less lacerated. Again, the two layers of which it is composed may be drawn out and for a time smoothed away, subsequently reforming. The flaps of the torn hymen go to form the *carunculæ hymenales s. myrtiformes.*

Uterus and Oviducts.

§ 51. The great bulk of the *uterus* consists of muscular fibres. The delicate serous membrane lining the organ is most closely connected with the muscle at the fundus and along the middle line, more closely also on the anterior surface than on the posterior; towards the cervix and the sides, the connection becomes more and more loose (*cf.* § 43). The bundles of *muscular fibres* interlace in all directions, and yet it is possible to make out several layers, though less distinctly than in the intestine. The *subserous* layer covers only the fundus and body; beneath it lies the *supra-vascular* layer, which occupies the same uterine area, but extends to the neighbouring organs as well, and is largely continued into the lateral appendages, enveloping also the vessels which pass in and out at the sides. The middle and by far the most important layer, the main constituent of the uterine tissues, is the *vascular;* it consists of bundles of fibres which cross each other in all directions, is traversed by numerous large, chiefly venous, vessels, and with them its fibres are intimately blended. The *more internal submucous and intramucous* stratum (in which traces of an original division into two lateral halves can still be detected) consists for the most part of concentric fibres, which arise from the uterine portion of the oviduct, form continually increasing rings, and at last meet in the middle line. They extend down to the cervix and vagina, and form, both at the orifices of the oviducts and at the internal and external os, true sphincters, of which that at the internal os occasionally forms a distinct projection on the internal surface, and may give rise to an isthmus 3 mm. (·1 in.) in height.

Immediately beneath the mucous membrane, lies a triangular (with the point directed downwards) longitudinal layer, both in the anterior and the posterior wall; it lines the whole of the cavity, and sends delicate bundles of fibres to the mucous membrane.

In the cervix the principal layers are arranged in much the same way; the circular fibres of the circular layer of the body, form the middle and principal cervical layer, this being bounded externally by longitudinal fibres, which become lost on the surface of neighbouring organs; the innermost layer is longitudinal, as in the case of the body of the uterus, sends some fibres to join the mucous membrane, and is interwoven with the sphincters.

§ 52. The *mucous membrane* of the uterus is of a pale red colour, and thinner near the oviducts and the cervix than elsewhere. It is unprovided with any submucosa, and is not readily separable from the muscularis, with whose constituent elements it is connected. Nor has the uterine mucous membrane the usual connective tissue frame-work; it consists rather of an embryonic nucleated and highly cellular form of connective tissue, in which run numerous large lymphatics (the endothelial cells which lie in contact with the delicate fibres and bundles of connective tissue, cannot belong to any other structures). In this tissue are the test-tubelike *uterine glands*, consisting of a delicate membrane lined by an epithelium which becomes ciliated towards the orifices, and bearing most resemblance to the crypts of Lieberkühn in the intestine. The membrane lining the glands, is formed in its deeper portion of a fine layer of delicate bundles of connective tissue, with the external surface of which endothelial cells are in contact; but nearer the glandular orifices, of a mere sheath of endothelium, so that the glands actually pass through the lymphatic spaces (Leopold). These glands are closely agglomerated, and their blind extremities, which usually reach into the muscularis, may be single or bifid, and are not uncommonly twisted in corkscrew fashion; each gland may have an orifice, or else two or three glands own a common mouth. The exposed surface of the mucous membrane is smooth, except in the vicinity of the openings of the oviducts, where small rugæ are present; papillæ are absent. It is provided with a single layer of ciliated epithelium (the ciliæ move from without inwards), which is subject to a constant renewal (during menstruation); the surface is covered by a thin layer of grey viscid alkaline fluid.

The mucous membrane of the *cervix* is sharply marked off at the isthmus, from that of the body, and is thicker, tougher and lighter coloured; moreover between it and its muscularis, especially behind, is a layer of areolar tissue. The mucous membrane is thrown up into numerous transverse rugæ, which are arranged along an anterior and posterior longitudinal raphe, and form the *palmæ plicatæ* or *arbor vitæ*, the anterior being chiefly placed on the right side, the posterior on the left. It is possible also, at the point where the anterior wall is continued into the posterior, to make out a longitudinal raphe on each side, so that four columns of transversely arranged rugæ are thus constituted. Between and in the substance of the latter, the mucous membrane of the upper two-thirds of the canal, and sometimes also lower down, is prolonged into deep glandular follicles, which in children are globular, but in adults become tubular or swollen at their extremities. These follicles are so numerous that the cervical mucous membrane may be regarded as a great glandular organ; their contents are perfectly clear, viscid, alkaline in reaction, and contain large mucus and goblet cells. The epithelium of these follicles consists, like that of the whole cervical canal, as far as the external os, of ciliated cylindrical cells (in adults however, especially in multiparæ, the squamous epithelium of the vagina reaches sometimes 1—3 mm. (·05—·15 in) up the canal, and is succeeded for an equal distance above by a transitional epithelium). In the lower half of the cervical mucous membrane, the mouths of the glands are separated by small vascular papillæ covered with ciliated epithelium, and which accumulate at the external os, when it is uninjured, and give it a ring-shaped lip or edge. Moreover in addition to the glands, and extending as far as the outer surface of the portio vaginalis, may be seen a variable number of closed prominent vesicles—*ovula Nabothi*—which are cysts filled with retained secretion. The outer surface of the *portio vaginalis* has the same formation as the mucous membrane of the vagina, but possesses very many simple and compound papillæ. Glands as a rule are absent; but where present their number varies greatly in different individuals.

§ 53. The *arteries* of the uterus are derived from the uterine branches of the hypogastric arteries and aorta, and from the external spermatics[1], and up to their entrance into the uterine parenchyma, have a partly very tortuous, partly spiral course. The arteries from each side anastomose within the muscularis, and after supplying the uterine glands with a system of capillaries, form beneath the mucous membrane a superficial irregular net-work of large vessels, which open into thin-walled valveless *veins ;* these latter uniting to form the uterine and pampiniform plexus. In the cervix the vessels are arranged more regularly, but (especially the arterial and capillary branches) they possess such thick coats, that the lumen scarcely amounts to a third of their diameter. In the partition walls separating the glands, the arteries run at right angles to the surface, but in the neighbourhood of the lips of the cervix, there pass from the arteries into the muscular coat, a number of parallel tortuous branches, which reach to just under the surface. Immediately beneath the epithelium they form a capillary net-work, which sends a vascular loop to each papilla; these loops at once open into wide venous channels, which run parallel with the arteries, and with them penetrate into the deeper tissues (Henle). This arrangement of the blood-vessels seems specially adapted to allow of sudden dilatation and contraction. The *lymphatics* of the uterus are very numerous, and especially distinct beneath the serous membrane of the fundus and at the sides. They originate in the mucous membrane, where both glands and blood-vessels pass directly through the lymph spaces, being separated from them merely by an endothelial sheath, formed of connective tissue; on reaching the surface of the muscularis, the lymph spaces pass some distance into infundibular depressions between two bundles of muscle, and gradually contract into the inter-muscular lymph vessels and spaces, which finally unite into large vessels lying in the external layer and especially at the sides of the uterus, open into the subserous lymphatics, and from these pass with the pampiniform plexus to the lumbar glands (Leopold). The lymphatics from the cervix pass to the pelvic glands.

The *nerves* of the uterus are derived from the cervical and neighbouring ganglia, and from the hypogastric plexus. They are composed partly of medullated, partly of non-medullated or pale fibres, and are most numerous in the cervix. They divide in the muscular tissue, and are connected (at any rate in lower animals) with ganglia beneath the mucous membrane; their more minute relations are not yet accurately known.

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[1] Arteria spermatica externa = cremasteric artery (New Sydenham Society's Dictionary, *vide* "Arteria").—Tr.

§ 54. The *oviduct* is constructed on a similar plan to the uterus. Beneath the serous lining lies a vascular adventitia of connective tissue, which is succeeded by the two layers which form the main substance of the oviduct, *i.e.* its muscular coat. The thickest of these layers is arranged in a circular manner, and increases in thickness towards the uterus, its fibres passing in continually widening circles to join the inner portion of the uterine muscle. On the inner as well as on the outer side of these circular fibres, lie longitudinal bundles, which internally are connected with the mucous membrane, and externally send prolongations between the folds of the broad ligaments to the hilum of the ovary, and are continuous with the superficial layer of the fundus uteri; a few longitudinal fibres traverse the layer of circular fibres. The individual muscular fibres are mixed with much indistinctly fibrillated connective tissue, containing spindle-shaped cells. The mucous membrane (which possesses a delicate submucosa) is thrown into numerous folds, which run mainly in a longitudinal direction, and are some leaflike, some cone-shaped, some mere low ridges; in the isthmus the folds are all low, and give the lumen the shape of a radiating orifice; in the ampulla they are much more developed, though of varying size; they are moreover frequently supplied with simple and compound secondary folds (Henle). The interior of these plicæ consists of a vascular embryonic connective tissue with numerous spindle-shaped connective tissue cells. The mucous membrane has no glands; its epithelium, as far as the free edge of the fimbriæ and even beyond it, consists of a single layer of cylindrical ciliated cells, whose ciliæ move from without inwards, and produce a current, running from the abdominal to the uterine orifice.

Ovary.

§ 55. The chief constituents of a mature *ovary* are the epithelium (germinal epithelium) and the follicles (Graafian follicles), containing the ova; these constituent elements are supported and held together by a stroma of connective tissue, which is very vascular and supplied with muscle and nerve fibres. The peritoneum ends at a white line passing ringlike round the base of the ovary, and is there interrupted much in the same manner as it is by the fimbriated end of the Fallopian tube. The *surface of the ovary therefore resembles that of a mucous membrane*, and is covered by a single layer of cylindrical epithelium. In the case of very many ovaries, the epithelium is directly continuous with that of the Fallopian tube, though the ciliæ cease; some follicles of different sizes, and surrounded by a narrow vascular net-work, can be seen through the surface, or project slightly beyond it. Beneath the epithelium lies the *cortical substance* or *parenchyma*, whose outer layer (erroneously looked upon as a tunica albuginea) is denser and made up of shorter fibres than the deeper central and highly cellular stratum. The former contains a few large Graafian follicles and the young follicles, the latter most of the more advanced follicles with nearly mature ova. Then follows the vascular stroma of the hilum, known as *medullary substance* or *vascular zone*, into the outer portion of which the larger follicles may reach.

The largest portion of the stroma consists entirely of areolar tissue, which is dense towards the surface, more cellular deeper down; it is particularly rich in cells round the younger follicles, the cells being spindle-shaped and frequently provided with long processes. The larger vascular trunks pass through the layer of cells in order to reach the surface, and are accompanied by strong trabeculæ of connective tissue, which spread out in an umbrella-like manner, and form a supporting frame-work for the delicate cellular tissue. In consequence of the maturation and degeneration of the follicles, the stroma undergoes numerous changes. The *unstriped muscular fibres* of the organ are confined to the vascular zone; they lie in single longitudinal bundles round the larger and medium-sized arteries, and can only be traced as far as the edge of the parenchyma; they do not reach the walls of the follicles. The stroma is highly *vascular;* the hilum contains a plexus of wide veins, which form a kind of vascular bulb (ovarian bulb of Rouget); the arteries retain the corkscrew course which the larger branches already possess to some extent; the chief capillary net-work lies in the innermost coat of the follicles.

Lymphatics are found at the hilum; wide sacciform lymph spaces surround the follicles and the corpora lutea somewhat like a capsule. Delicate *nerve fibres*, provided with a very thin medullary sheath, penetrate as far as the larger follicles.

§ 56. In a *Graafian follicle that is approaching maturity*, may be distinguished the connective tissue coat (*theca folliculi*), the epithelium (*membrana granulosa*) and the *germinal disk* (*discus proligerus*); the latter usually contains the ovum, is formed by a heaping up of the epithelium, and projects free into the lumen, the remainder of the cavity being filled by the clear liquor folliculi. The wall of the follicle may be divided into the outer tunica fibrosa and the inner cellular tunica propria, but these layers pass into one another without distinct boundary. The cells of the epithelium are cylindrical and devoid of distinct walls; they are easily shed and, together with the fluid transuding from the blood, form the paralbumin-containing *liquor folliculi*. In the discus proligerus the cylindrical cells completely invest the ovum, on which they are placed, and to which they adhere like an ordinary *epithelium*. The ovum with the discus proligerus lies sometimes in the deepest, sometimes in the most superficial portion of the follicle. It is composed of an investing membrane, the strong clear homogeneous *zona pellucida*, which is pierced by numerous minute pores and derived from a cuticular transformation of the protoplasm of the epithelial cells; of the very granular cell protoplasm or *vitellus*; of the somewhat eccentrically placed large circular bright and sharply defined nucleus, or *germinal vesicle* (a mature ovum has never been observed to contain more than one germinal vesicle), and of the macula germinativa, or *germinal spot*; in addition to the latter, there are several small round and not yet accurately described bodies. The whole ovum represents a large uni-nucleated highly protoplasmic cell, and is merely a specially developed and differentiated epithelial cell of the ovary.

The *parovarium*, or organ of Rosenmüller (epoophoron—Henle), is embedded in the broad ligament near the ovary (*cf.* § 41), and consists of 12 or 15 tubes, ·3—·5 mm. (·012—·02 in.) in diameter, which end blindly at both extremities. It is the *remnant of the sexual division of the Wolffian body*; the walls of the tubes are composed of an external circular, and an internal longitudinal fibrous coat, and are lined by ciliated epithelium; the tubes themselves contain a clear fluid, which is coagulated by acetic acid. Vestiges of the *primordial kidney division of the Wolffian body* (paroophoron—Henle) are also found on the median side of the parovarium in the broad ligament, and to them a portion of the small cysts, which are so common in this region, probably owe their origin.

Mammary Gland.

§ 57. The mammæ, surrounded by a considerable quantity of fat, and covered by loose delicate skin, lie on each side on the pectoralis major muscle, from the third to the seventh rib; they are separated from the muscles by the superficial fascia, and from each other by a groove, which runs parallel to the sternum. Their development resembles that of other cutaneous glands, their structure that of a large racemose gland, such as the parotid. Their growth is most rapid about the time of puberty, although development is only completed during pregnancy.

The substance of the gland consists of numerous (15—24) distinct *lobes*, which may be of variable size and irregular shape, but are usually flattened and angular. They are not always easy to disentangle, although as a rule separated from each other by interspaces filled with fat; the various lobes are made up of lobules, these finally being composed of terminal acini. All these elements are surrounded by an abundant tough white connective tissue, which binds them into a whole, and connects them with the subcutaneous connective tissue. Formed by the coalescence of the excretory ducts of the lobules and their subdivisions, a wide duct passes out from each lobe, of varying length, but usually about 2 mm. (·08 in.). This is the *milk duct* —ductus lactiferus—which runs towards the middle of the gland, *i.e.* the *nipple*, unites with other smaller ducts as it does so, and dilates beneath the areola in the neighbourhood of the nipple into an ampulla of 4—8 mm. (·15—·3 in.)—*milk saccule*, sinus lactiferus. It then contracts to ·4—1 mm. (·015—·04 in.), approaches to, without however anastomosing with, the other ducts, perforates the nipple, and ends at its summit by an aperture measuring ca. ·5 mm. (·02 in.) The *acini of the gland* are invested by areolar tissue, which presents rows of elongated nuclei. The membrana propria is covered externally by an endothelium, which helps to form the walls of the peri-alveolar lymphatics, the latter surrounding the alveolus to a far greater extent than do the blood-vessels. The epithelium of the acini consists of a single layer of cubical cells, which when seen from the surface appear polygonal, and are connected by a distinct cement substance; on approaching the excretory duct, the cells become longer and cylindrical. The epithelial cells of the acini are always free from fat; their protoplasm is granular, the nucleus large, often angular or indistinctly separated from the protoplasm. In the portion of the cell next the lumen of the acinus, lie vacuolelike globules, which are liberated at intervals, and pass into the lumen, while the body of the cell with the nucleus remains at the wall of the alveolus, the border facing the lumen of the latter taking on a teased-out appearance. In the interior of the alveolus lie some fat globules and bodies resembling lymph corpuscles; they are probably white blood-corpuscles, which have migrated and undergone fatty degeneration. The walls of the excretory ducts are composed of delicate fibrillated connective tissue, which in the case of the larger ones is thrown into longitudinal folds; the fibrillæ on the outside are close-set, circular and interwoven with numerous elastic fibres; the epithelium consists of low cylindrical cells, except in the neighbourhood of the opening, where it changes to the stratified squamous variety.

The conical (sometimes cylindrical or hemispherical) *nipple* is usually situated a little to the abdominal side of the middle of the gland, and is directed slightly upwards and outwards. Its length and thickness vary greatly. Like the circular or usually elliptical portion of skin 3—5 cm. (1·2—2 in.) in diameter, which surrounds it and is called the *areola*, the nipple has, except at its apex, a rosy or brownish colour, which generally varies in depth with the tint of the skin. Both possess numerous muscular fibres; those in the areola surround the base of the nipple in concentric circles, becoming better developed the nearer they lie to it; there are however also radiating bundles interwoven with the latter, and running beneath the nipple. The muscular fibres of the nipple form a net-work, which encloses the milk ducts, and it is this mechanism which causes the nipple, when touched, to become harder and more pointed, at the expense of the areola. The musculature of the nipple moreover forms a sphincter, which makes it possible for the milk ducts to attain their maximum repletion, before the flow of milk begins. The epidermis, especially the horny layer, is very delicate over the areola. Immediately beneath the cutis lie, sometimes in a circle round the base of the nipple, sometimes scattered irregularly, large sebaceous cysts, collected in a more or less racemose manner, and furnished with fine hairs; they often form small tubercles and contain a colostrumlike secretion *(accessory milk glands*—Henle, *glandulæ lactiferæ aberrantes*—Luschka, *glandes auréolaires*—Duval, *Montgomery's or Roederer's glands);* their secretion preserves the delicate and brittle epidermis from cracking. The surface of the nipple is rough, almost fissured, covered with closely set papillæ, many of which bear minute secondary vascular papillæ, over which the epithelium passes smoothly. The milk ducts follow the axis of the nipple, their orifices lying between the conical papillæ.

The blood-vessels form a moderately close capillary net-work round the acini; in the areola the veins form a more or less perfect circle (circulus venosus Halleri).

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PART II.

PHYSIOLOGY AND HYGIENE OF PREGNANCY, PARTURITION AND THE PUERPERAL STATE.

1. *Pregnancy.*

§ 58. The capacity for reproduction commences as soon as the generative organs reach maturity. The changes on which that maturity depends, vary at different periods in their rate of progress, but they are nevertheless in constant operation on the generative organs, preparing them for functional activity. So long as the body has to provide for its own development, and consequently requires a large amount of formative material, it has no energy to spare for propagating the species. Till development has ceased, the organs which serve for that purpose, remain inactive and small, and most of the important distinctions between the two sexes are absent.

The *ovaries* and the *ova* contained in them, are the first to arrive at maturity. By the age of 2½—3 years, the ovary has already the shape of the adult organ, and the formation of fresh ova has ceased; the organ however is still very small, and the external cortical layer (albuginea) has not yet assumed the structure it possesses later on. The separate follicles in the follicle-bearing zone are gradually pushed further apart by a growth of the intervening tissues, and in this way the whole organ increases in size; each follicle also grows larger, and its epithelium (whose cells are now cylindrical) becomes more abundant. The larger follicles often reach into the vascular zone, while a few, and as a rule the largest, advance nearer to the surface and even project beyond it. The whole ovarian parenchyma becomes more and more vascular, the ovarian "bulb" more distinct.

The actual approach of sexual maturity, i.e. *puberty*, manifests itself by the spontaneous discharge of an ovum from its follicle (*ovulation*), by the accompanying discharge of blood from the generative organs (*menstruation*), and by the regular periodical recurrence of this event. These two phenomena (expulsion of ovum and discharge of blood) are closely connected with each other, although they are not necessarily both present. The exit of the ovum and the bursting of the follicle have (as I was the first to show) been preceded for a long time by preparatory processes, consisting of a luxuriant new formation of vascular loops in the tunica propria (leading to a distention of the cavity, and preparing the way for expulsion), as well as of a fatty degeneration and a consequent weakening of the wall of the follicle. The increase in size of the ovary, caused by continued growth and new cell formation, acts as a constant stimulus to the nerve fibres running in its tense parenchyma, and as soon as these stimuli reach a certain intensity, the ovaries become congested by some form of reflex action. Under its influence a more copious exudation into the follicle, a more abundant exit of migrating cells and a greater proliferation of its wall take place, and these processes raise the tension to such a pitch, that the weakest part of the free surface of the follicle, *i.e.* the *stigma*, where neither blood- nor lymph-vessels exist, gives way, tears, and the ovum passes out.

Simultaneously with, or possibly even somewhat earlier than the ovaries, the remaining genital organs become greatly congested; they swell, become more abundantly infiltrated with serum, and secrete more freely; the mucous membrane of the uterus also becomes highly congested, leading to the formation of the *decidua menstrualis*, which only differs from the decidua of pregnancy, by the small round cells which compose the interglandular tissue (Wyder). If the ovum is not impregnated, the superficial greatly distended capillaries of the mucous membrane rupture, this being facilitated by there being but very few veins to carry off the blood. In consequence of this rupture and the hæmorrhage (menstruation) which follows it, a varying quantity of the cells of the epithelium and mucous membrane are thrown off; at an early period they are not at all or but slightly altered, but in the later days of menstruation, they will be found in a state of fatty degeneration. This fatty degeneration and discharge of cells however are not necessary to the flow of blood (Leopold, Wyder); the latter can in all probability ensue without any extensive rupture of the blood-vessels, namely per diapedesin[1].

Connected with the above described state of congestion, are a number of constitutional symptoms, in part the result of the vascular disturbance, in part reflex and correlated phenomena; to these belong the common temporary swelling and heightened sensitiveness of the breasts, as well as the usually increased sexual desire. The amount of swelling and the degree of capillary engorgement determine whether the usual discharge of blood shall occur during ovulation, or remain absent, as is known sometimes to happen; similarly it is intelligible that where there is unusual resistance to the rupture of a follicle, the extrusion of the ovum may not take place, although the menstrual flow is quite natural.

§ 59. When once the appearance of menstruation has indicated the approach of sexual maturity, the events above described recur every month, on an average every 26th to 28th day (28th, 27th, 30th in order of frequency); it is not rare however to meet with cases in which the interval is irregular, especially near the commencement and cessation of menstruation. The flow of blood continues in most cases for 4—5 days, but in this respect also variations are common. The blood itself has no special characters, although as a rule it is discharged in an uncoagulated state, and mixed with mucus and the various forms of superficial cells of the generative organs.

The period of maturity amongst us usually begins between the 13th and 15th year, but in this as in the time of the menopause, great variations on both sides of the normal are met with; in our climate the higher figures are the usual ones. Individuality (*e.g.* brunettes are said to menstruate somewhat earlier than blondes[1]), heredity, social position and mode of life[2], as well as climatic influences are determining factors; but extremes occur in every part of the world.

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[1] The results of my examination of a piece of apparently healthy mucous membrane, taken from a completely inverted, but otherwise healthy uterus, are in favour of this possibility. During menstruation, while perfectly fluid blood was everywhere oozing from the uterus, I removed a portion of the mucous membrane; it showed nothing abnormal except an unusually great dilatation and engorgement of all the blood-vessels, even of the smallest capillaries, and aggregations of migrating cells, which were collected in small groups, in many respects like minute abscesses, and appeared dark and granular; there were but few and very small extravasations of blood. The surface of the mucous membrane was intact, except that at a few spots the superficial layer of epithelium was absent.

The arrival at puberty however is generally not coincident with the complete development of all the generative organs, and especially not of the uterus; the latter continues to grow considerably up to the 20th year, and only at that age is the woman perfectly fitted to become a mother, without special risk for herself or her offspring.[3] The duration of sexual maturity extends according to L. Mayer and Tilt over a period of 30—32 years; as a rule it lasts longer, the earlier the first catamenia commenced, and *vice versa;* numerous confinements, suckling and even a late confinement have a prolonging influence (Cohnstein).

§ 60. After bursting, the Graafian follicle collapses, and its wall is thrown into folds. The formation of new cells and vessels starting from the theca interna and the membrana granulosa, as well as the fatty degeneration which brought about the rupture, now proceed with renewed activity, and lead to retrograde changes in the follicle, by the formation of the already prepared *corpus luteum.* This structure only attains its full development after some weeks, indeed, when pregnancy has set in, only in the 2nd or 3rd month. At that time it is larger than the original follicle, and may be divided into a central light coloured portion, and an intensely yellow cortex, which is convoluted somewhat like the brain, traversed when fully developed by distinct minute vessels, and surrounded by the tunica fibrosa of the follicle. The central portion contains a very vascular gelatinous connective tissue, in which lie numerous large cells filled with pigment granules and also hæmatoidin crystals derived from the effused blood, and from the cells of the tunica granulosa which have been broken up; whether however rupture is always accompanied by extravasation of blood into the follicle is doubtful. The cortical zone contains large cells derived from the tunica granulosa, which are more or less circular in outline and finely granular; between these and projecting into the cavity on all sides, are very numerous vascular processes, sprouts so to speak of the tunica intima; they are the cause of the folds seen in the corpus luteum, the fatty degeneration of the cells giving rise to the colour. The epithelial portion of the corpus luteum disappears early, the fat is absorbed, the thick-walled arteries gradually atrophy, and merely the connective tissue frame-work, derived from the coats of the vessels, remains and forms by its contraction a small stellate cicatrix becoming less and less distinct (*corpus albicans*). When pregnancy has supervened, owing to the heightened vascular tension and the increased formative activity of the sexual organs, the proliferation takes place more actively and lasts longer; the corpus luteum, now called *verum*, reaches a much larger size, assumes an intensely yellow colour, and persists to the end, and even beyond the end of pregnancy; cases however occur where the corpus luteum of pregnancy is missing, or very slightly developed.

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[1] Westhoff however (*Ueber die Zeit des Eintritts d. Menstruation. Dissert.* Marburg, 1873) in his examination of 3,000 persons in the Hospital at Marburg, came to a different conclusion, as also did Osterloh (*Jahresbericht d. Gesellsch. f. Natur. u. Heilk. in Dresden*, 1877—78) from his collection of cases.

[2] In the less well-to-do and labouring classes, menstruation does not usually begin till the 15th—18th year.

[3] The marriageable age fixed by law is indeed a much lower one; it varies (*cf. Lyon méd.*, 31st May, 1879) in different countries between 12 and 16. There are some instances of *extremely early pregnancy* on record; amongst others one at 12 years in *Med. Times*, 1877, i., p. 568; 1879, i., p. 96; *Petersb. Med. Woch.*, 23rd Aug., 1879; *cf.* also Underhill in *Amer. J. of Obstetr.*, xii., p. 101. As an illustration of the opposite extreme, Barker relates a case (Underhill, p. 104) of confinement in the 58th year.

§ 61. The ovum, enclosed in its epithelium, emerges slowly from the follicle, and is conducted by the ciliated lining of the fimbriæ towards the abdominal end of the Fallopian tube. Thiry's observations (*Göttinger Nachrichten*, 1868) of this event in the Batrachia, the normal connection of the ovary and the oviduct effected by the fimbria ovarica, the close contact of the fimbriæ with the neighbouring organs, the active current produced by the waving of the ciliæ in the almost capillary clefts in the fimbriæ, the extra-uterine migrations of the ovum (*cf.* Extra-uterine Pregnancy) leave no doubt on this point. The ovum is assisted on its descent to the uterus by the ciliary movement in the mucous membrane of the Fallopian tube, and by the contractions of the circular fibres in its middle narrowed portion, though it probably takes a considerable time (8—12 days) to travel over this distance. If it is not fertilised meanwhile, it disappears without leaving a trace; should the opposite occur, it fixes itself on to the uterine mucous membrane, and becomes embedded in it, in order to undergo further development.

Conception—fœcundation—consists in the intimate union of the semen and the ovum, in the entrance of the spermatozoa into the vitellus through the minute pores of the zona pellucida, and the consequent fusion of the two essential portions of the male and female elements. During sexual intercourse, the spermatozoa are rapidly carried into the uterine cavity, partly by their inherent power of locomotion, and probably partly by an aspiratory action of the cervix, produced by an erection followed by relaxation of that organ, which is permitted by its peculiar (*cf.* above) vascular arrangement (Wernich, Rouget); they then pass by means of their own motion, and the ciliæ of the uterine mucous membrane, into the Fallopian tubes. Here, and especially in the ampulla, the little pits on the surface of the folds, and the innumerable and complicated passages between them, afford them a place of shelter, in which they are detained, distributed and nourished. The ampulla of the oviduct thus becomes in a measure a receptaculum seminis, and in it the union between the ovum which has arrived from the ovary, and the spermatozoa probably very often takes place. From this point also after impregnation, the quickly growing ovum passes directly and rapidly through the isthmus. Fertilisation however may occur in any other situation between the ovary and the uterine cavity, the spermatozoa may even reach the peritoneum, and it is by no means rare for fertilisation to take place in the ovary itself. The seat of the occurrence depends on the difference in time between the fruitful coitus and the extrusion of the ovum; but when we remember the prolonged vitality which the seminal particles possess in the ampulla, it seems probable that in the majority of cases fertilisation is effected in that portion. At all events it is clear that sexual intercourse and conception are usually not simultaneous, and need not coincide.

§ 62. As soon as the ovum is fertilised, the woman is *pregnant*. During this condition, the ovum develops till the embryo has become completely mature, and the preparations for its expulsion (for birth), as well as those for the subsequent nourishment of the child are carried on.

The *duration* of pregnancy varies within certain limits. It is impossible absolutely to fix it, since even when the ovum belonging not to the last menstruation, but to the next ovulation (occurring without loss of blood, owing to the conception that has taken place) is impregnated, we can only rarely be sure of the date of the last ovulation, and since owing to prolonged vitality of the spermatozoa in the ampulla, and to the unknown duration of the migration of the ovum, it is not possible in any individual case to fix the interval between coitus and conception. Reckoned from the day of fruitful coitus, the average duration amounts to 272 days (according to Löwenhardt's statistics[1]), and the greatest number of births take place in the 39th, and next to that in the 40th week. Reckoned from the *first* day of the last menstruation, the duration of pregnancy amounts to 282 days (Löwenhardt), reckoned from the *last* day, to 278 days (Duncan); so that the great majority of women, about 73 p.c., conceive within the first week after the termination of menstruation, on an average on the 11th day from the first day of menstruation inclusive[2]. The deviations from the average duration calculated in this way, lie chiefly between the 265th and the 280th day; the instances in which a fœtus attains maturity at an earlier epoch are rare; somewhat more frequent are those in which intra-uterine life extends beyond 280 days. Individual peculiarities have doubtless an influence over the duration of pregnancy; for instance a first pregnancy, or one consequent upon marital intercourse, is said to last a shorter time than the contrary conditions. If the duration of pregnancy depends on the menstrual cycle, as supposed by Cederschjöld and Berthold (according to the former, parturition occurs on the day on which the menses would have appeared for the tenth time, if pregnancy had not supervened; according to Berthold, when the ovary is preparing itself for the tenth recurring menstruation), or if Löwenhardt's view is true, viz. that the duration of pregnancy is equal to ten times the *menstrual interval which preceded* it (the ovum requiring 9 separate catamenial periods of the mother for its full development), the duration of pregnancy must vary in individual cases with the type of menstruation, and indeed vary in the same woman in different pregnancies, which as a matter of fact it does (Ahlfeld).

§ 63. In furtherance of the objects mentioned above, a series of changes take place during pregnancy both in the maternal system and in the ovum, progressive changes which run side by side, and are often connected with one another, though hardly standing in the relation of cause and effect. In the maternal organism, the generative organs, especially the uterus, present the earliest and most important changes, these manifesting themselves mainly by a hypertrophy of the various constituents; hand in hand with these alterations others take place in the neighbouring organs, partly of a mechanical nature, partly necessitated by the vascular supply being a common one. A third series is due to the influence of the local changes on the entire organism, on the centres of nutrition, the blood and the nervous system. A detailed description of the development of the ovum, of the building up of the embryo and its several organs, does not belong to Midwifery, and I must for this information refer to text books of Embryology; on the other hand a description of the condition of the ovum in the several months of pregnancy and at maturity, and an account of the origin and function of the fœtal appendages, are of so much importance in the practice of Midwifery, that a special chapter must be devoted to them.

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[1] Ahlfeld gives 271 days; Duncan basing his opinion on 46 cases, 275; Stadfeldt (*Annales Gynécol.*, viii., 1877, p. 227) 272 days from an experience of 65 cases.

[2] Stadfeldt (*l. c.*) estimated that in 24 cases in which he thought he was able to fix the date of the first missed menstruation, *i.e.* of the fruitful ovulation, the duration from that date was 254 days—which coincides with the supposition that conception takes place on an average 11 days after the commencement of the last menstruation.

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SECTION I.

CHANGES IN THE MATERNAL ORGANISM.

A. *In the Generative Organs and their Vicinity.*

(1) *Uterus.*

§ 64. The changes in the generative organs consist mainly in an increase in size, resulting from a prolonged and abundant supply of nutrient material. The most important and striking of them take place in the uterus, in which the fertilised ovum is to become embedded and to continue its development, and which must provide it with material for growth and ultimately expel the mature fœtus.

The hyperæmic condition which is associated with ovulation, increases considerably when conception occurs; the swollen *mucous membrane* rapidly thickens, the decidua menstrualis becomes the decidua graviditatis. The larger *muscular cells* attain to a gigantic length, increasing 7 to 11-fold in this dimension; their breadth increasing 2 to 5-fold. Moreover a number of embryonic muscle cells, kept in reserve for the purpose, develop into larger and contractile cells; this occurs especially during the first 5 months, and in the inner layers of the uterine wall[1]. The scanty areolar tissue which unites the muscular bundles, becomes more abundant, looser, and towards the end of the pregnancy, shows distinct fibrillæ. The *serous* lining increases in thickness and grows with the whole organ, so that all the surface which was invested in the non-gravid state, continues to be so.

The *blood-vessels* and *lymphatics* increase in size as well as in length; their terminations are prolonged. The arteries especially are greatly lengthened, assume a spiral course, and in some places open directly into veins. The latter are considerably wider, anastomose frequently with each other, and form especially at the placental site a wide-meshed net-work, in which the various vessels run together at an acute angle and thus form a fold projecting towards the lumen (W. Hunter, Goodsir); moreover the increased muscular elements of these veins are very intimately connected with the uterine muscle, so that the vessels form flattened channels between the muscular bands (*uterine sinuses*). The circular vein at the internal os has grown to be as large as and in every respect very similar to a sinus. The lymph vessels form on the surface of the uterus, especially at the fundus and sides, extensive well marked net-works with large "lymph lacunæ" at various points, and penetrate to beneath, and even into the mucous membrane, which thus forms the wall of a great lymph sinus (*cf.* §§ 52, 53). The *nerves* increase in thickness and length, retain their dark-bordered outline for a greater distance, and reach as far as the mucous membrane; their larger size however is mainly due to a growth of the neurilemma. In the inner layer of the uterine wall, ganglia have been observed (*cf.* my paper in *Monatschrift f. Geb., XXIV.*, p. 12, 13).

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[1] If the supply of embryonic cells has once been used up, it is probable that no fresh pregnancy can occur, or at any rate run on to term.

§ 65. It is by means of these textural changes that the enormous *increase in the size and cavity* of the gravid uterus and in the *thickness of its walls*, in short that the eccentric hypertrophy is brought about. The organ which is ca. 6·5 cm. (2·5 in.) long in a virgin, has at the end of pregnancy a length of 35 cm. (14 in.), the width increases to 24 cm. (9·5 in.), the depth to 23 cm. (9 in.); the cavity is increased 519 times (Krause), the weight 24 times (Meckel). The degree of enlargement of course varies a good deal[1] with the size of the embryo, the volume of the liquor amnii and of the placenta, yet the increase continues up to the end of pregnancy; it occurs to some extent even where the ovum does not develop in utero, proof that there is an actual increase in bulk. Towards the end of pregnancy however, the ovum does, by distending the parietes, assist in increasing the bulk of the uterus, for the thickness of the walls (which increased

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[1] According to Farre (*l. c.*, p. 645), and Tanner (*l. c.*, p. 90), the uterus has the following dimensions in the different calendar months:—

	LENGTH.	BREADTH.	DEPTH.
End of 3rd month	12—13·5 cm. (4·7—5·3 in.)	11 cm. (4·3 in.)	8 cm. (3·1 in.)
" 4th "	15—16 cm. (6—6·3 in.)	13·5 cm. (5·3 in.)	11 cm. (4·3 in.)
" 5th "	16—19 cm. (6·3—7·5 in.)	15 cm. (6 in.)	13·5 cm. (5·3 in.)
" 6th "	21·5—24 cm. (8·5—9·4 in.)	17·5 cm. (7 in.)	16 cm. (6·3 in.)
" 7th "	27—30 cm. (10·5—11·75 in.)	20 cm. (7·8 in.)	17·5 cm. (7 in.)
" 8th "	30—32·5 cm. (11·75—12·75 in.)	21·5 cm. (8·5 in.)	19 cm. (7·5 in.)
" 9th "	32·5—37·5 cm. (12·75—14·75 in.)	25·5 cm. (10 in.)	21·5—24·5 cm. (8·5—9·6 in.)

during the first months) becomes less towards the end of pregnancy, when compared with the earlier months, indeed it may sink below that of the unimpregnated organ.

The arrangement of the muscular fibres is still very complex, but the several *layers* are more distinct than before the onset of pregnancy, and broadly speaking the same description holds good (*cf.* § 51). The middle vascular layer is the thickest, and contains the net-work of wide uterine sinuses, with whose coats the muscular fibres are closely blended. The inner and outer layers have become more independent; the rings round the apertures of the oviducts and the internal os are stronger, so also is the triangular submucous lamina, the point of which is directed downwards. The subserous layer forms a median longitudinal band, which starts from the lower end of the posterior surface of the body, and in front descends nearly to the cervix (Hélie); at the sides, its fibres are interwoven with those (directed transversely or obliquely upwards) of the supra-vascular layer, which is placed like a hood on the body of the uterus (Luschka), and whose fibres radiate into the ovarian and broad ligaments, encircle the vessels passing in and out at the side of the uterus, and, by interlacing in various planes, form contractile rings round the vessels.

When a uterus has undergone all these changes, it reacts much more readily to stimuli than does the empty organ; contractions are frequent during pregnancy, and sometimes set in spontaneously, *i.e.* without apparent external exciting cause. The pregnant woman is usually not conscious of them, or has merely a sensation of fulness, especially during the last weeks. They are not however without importance, since they accelerate and maintain the blood-flow in the wide uterine and placental sinuses, and assist in producing a fœtal "lie" corresponding to the form of the uterus, as well as in keeping the fœtus in that position.

§ 66. The growth of the uterus is accompanied by *alterations in its shape and position*. During the first three months the pyriform appearance is usually retained; but by degrees the egg-shape becomes more distinct, the body appears rounded owing to a relatively greater increase in its width and depth, and its form approximates sometimes to a short ovoid, to whose point the little cervix is attached, sometimes to a somewhat flattened spheroid. Owing to the inclination of the fundus forwards, and to the slight resistance presented by the anterior abdominal wall, as compared with the resisting substratum opposed to the posterior uterine wall, the anterior is thrust further out than the other, and more sharply flexed on the cervix than before, sometimes even at an acute angle. Since after the sixth month the longitudinal diameter increases most, and the upper segments of the body widen more rapidly and to a greater extent than do the lower ones, the organ comes at last to assume the ovoid shape (with the smaller extremity below) which it has at the termination of pregnancy. Still even in the last three months numerous variations in the shape of the uterus take place, depending chiefly on the position of the pregnant woman, the bulk of the uterine contents, the position of the embryo, the tension of the organ, and also on its natural conformation. The uterus has this typical egg-shape, only when in a state of contraction, when its walls are neither compressible nor elastic; in the relaxed condition, the shape may be modified in various ways by the different forces acting upon it, *e.g.* the surfaces which support it, the stretched abdominal muscles, and the neighbouring organs; the more flaccid the wall, the more will it of course be subject to variations of shape, and these are as a rule greatest in multiparæ.

As the uterus grows, it gradually ascends; in the third month it lies in the hypogastrium; it almost fills this region in the fifth, and towards the end of pregnancy reaches the epigastrium, in order ultimately to sink again a little, in consequence of the fœtus descending more into the pelvis and of the lower uterine segment becoming more stretched. In the erect posture, since the line of gravity falls in front of the pelvis, the uterus is supported by the anterior abdominal wall; the latter therefore bears the weight of the organ, and is bulged out by it so that the antero-posterior diameter of the body at this level (the greatest depth of the abdominal cavity amounts then to almost two-thirds of the total depth of the trunk, and lies at the level of the lowest lumbar vertebra), as well as the circumference are increased. In the horizontal dorsal decubitus, the uterus rests on the vertebral column and becomes elongated, while the depth of the abdominal cavity is somewhat diminished. The uterus is approximately vertical when the pelvic brim is horizontal, and this will be the case when the trunk is inclined to the horizon at ca. 30°, therefore in a posture half way between sitting and lying. Moreover the uterus rarely lies exactly in the middle, but (as in the non-pregnant woman) in the great majority of cases is inclined to the right side of the axis of the body, and usually slightly twisted in the same direction round its longitudinal axis, so that the left edge projects further forwards than the right; this lateral deviation depends mainly on an inherited tendency (*cf.* § 40), but is increased by the small depth which the abdominal cavity offers in the middle line, owing to the prominent spinal column, as well as by the force of gravity (most pregnant women lie on their right side). Exceptions to the usual inclination to the right, occur chiefly in cases where the mobility of the uterus happens to be unduly great, or where the left uterine horn is unusually developed.

When the abdominal cavity is comparatively wide, and especially when the abdominal walls are relaxed, the position of the uterus may vary greatly with the posture of the woman; it is however always the fundus that alters its position, not the lower division of the organ, for this is fixed in the pelvis.

§ 67. Under ordinary conditions the uterus in the latter part of pregnancy rests (fig. 19) with its anterior surface on the abdominal wall, only separated from it below by the bladder, which varies in extent according to its repletion; the lowest portion of the uterus is always supported by the pelvic brim, but especially by the anterior pelvic wall and the vaginal fundus. On very rare occasions a coil of intestine descends in front of the uterus, but only where there is extreme lateral deviation of the latter, and when the woman lies on the same side as the deviation. The posterior uterine wall is in contact below with the rectum, the promontory and the great iliac vessels; higher up it is for a short distance in contact with the lumbar vertebræ, the aorta and vena cava, but soon leaves them; in the interspace lie coils of small intestine. The sides of the uterus are surrounded by the abdominal walls and below also by the psoas and iliacus muscles, the external and internal iliac arteries and veins, in the middle and above by the cæcum and the ascending or descending colon, as the case may be. The fundus uteri is separated from the diaphragm in front by the transverse colon with the omentum and the great curvature of the stomach, more to the side and behind by remaining abdominal viscera. The pressure which is exerted upon all these organs by the uterus does not *disturb* them; their functions are not interfered with or to a very unimportant degree; the range of movement of the diaphragm however is usually somewhat restricted during the last period of pregnancy.

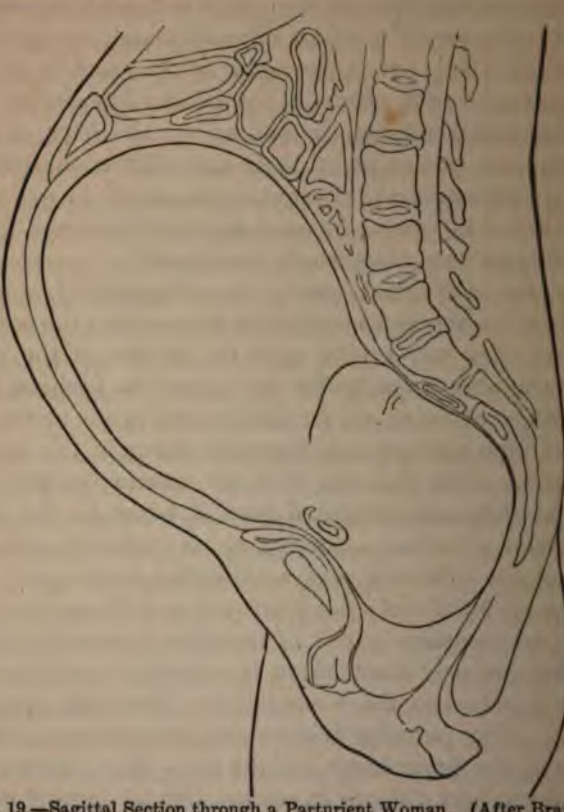

Fig. 19.—Sagittal Section through a Parturient Woman. (After Braune.)

§ 68. The *cervix uteri* participates in the hypertrophy of the whole organ; both its length and breadth increase, though only to a slight extent, and its growth is completed about the middle of pregnancy. Its mucous membrane takes no share in forming the decidua, and retains therefore its epithelium, though it has no ciliæ; its rugæ are more swollen, its mucous follicles grow larger and yield a plug of mucus, which fills the canal and, if it is not expelled for a considerable time and becomes inspissated, may be moderately firm.

In consequence of the active hyperæmia associated with the beginning of pregnancy, the *portio vaginalis* becomes copiously infiltrated with serum, and feels soft and spongy; the lips of the os lose the more or less sharp edge which they possess in the virgin, while the os owing to the less resisting condition of the lips, appears rounded and yields under the pressure of the examining finger. If the portio vaginalis has been injured in previous labours, the orifice has no longer its circular outline, the canal appears patulous, but the softness and sponginess of the walls is greater. This softening begins at the surface and at the lowest portion, and in this region is sometimes so great as to lead to a loss of the epithelium ("erosion of the lips"); as pregnancy advances, the softening involves regions situated higher up, and also affects a greater depth of tissue. Owing to the para-cervical tissue of the vagina and that round the insertion of the cervix also becoming softened, to the stretching of the muscular bundles passing from the fundus vaginæ to the cervix, to the tumid condition of the latter, to the ascent of the uterus, and to the sponginess and increased width of the cervix, the latter and especially the portio vaginalis appear to be much shortened, although as a rule no real shortening occurs till just before labour. *Real* shortening can only result from the stretched and tense wall of the lower segment of the uterus dragging upon the cervix, and by the upper portion of the latter yielding in consequence, and such a stretching generally speaking only occurs during the last days or weeks of pregnancy; occasionally it may take place earlier, *i.e.* during the last third of pregnancy, and again disappear when the tension is relaxed; but as a rule when once begun, it steadily progresses. This true shortening is sometimes *general*, sometimes only *partial*, according as one or other wall of the lower portion of the uterus is most stretched; as a rule it affects the anterior wall when partial, since this is the one which is generally forced down by the ovum. The partial shortening may lead to the obliteration, *i.e.* to an apparent retraction of the corresponding wall of the cervix, and even of the vaginal portion into the lower segment of the uterus, though the length of the canal remains unaltered; the uniform and entire shortening, the dilatation of the cervical canal which occurs almost solely in primiparæ, and in multiparæ only when they offer analogous conditions, does not lead to the complete effacement of the vaginal portion till the commencement of labour.

§ 69. The question whether the *cervical canal opens up at the internal os during pregnancy*, admits the lower end of the ovum and thus contributes to the enlargement of the uterine cavity, has attracted great attention during the last few years in consequence of Bandl's publications (*cf.* Literature), and there can no longer be any doubt that the changes referred to are possible, and do occur. The forces which effect the changes, are the resistance which the uterine parietes offer to the expansion of the ovum, and the contractions of the uterus. Both however under normal conditions, only come into operation during the last period of pregnancy. The pressure exerted by the growing ovum on the uterine parietes, makes itself felt most on the weak-walled lowest portion of the body, which contains almost only longitudinal muscular fibres ("area of expansion during labour," Duncan); it stretches this portion, and in so doing not infrequently opens up the internal os, more or less according as its edges offer much or little resistance. The sometimes imperceptible, but often subjectively distinct uterine contractions act in the same direction, and moreover drive the end of the ovum into the internal os. Since however the tension of the uterine wall, especially of its lower segment, is greater, and contractions are observed to set in earlier and more frequently in primi- than in multiparæ (probably as a result of the greater tension), the opening up of the cervical canal towards the end of pregnancy is much commoner in them than in multiparæ. In the latter the less resisting wall of the lower portion of the body of the uterus, yields more readily to the pressure, so that the latter is not so often transmitted to the edges of the os and to the walls of the cervix. Should this however occur, the *entire* cervical wall readily follows suit, while in primiparæ the portions lying far below the internal os, are still capable of offering resistance. Hence occasionally after repeated pregnancies, the whole cervical canal is found to be quite open and passable, even during pregnancy, while in primiparæ the lowest portion almost always remains closed up to the time of labour.

The possibility of the cervical canal being opened up in the manner described above, and being absorbed into the uterine cavity before the commencement of labour, has been disputed, on the ground that since the chorion is in close connection with the decidua, a separation of the two membranes would be necessary, and that as a matter of fact this separation is not met with. In regard to this point it may be remarked, that the end of the ovum over a small area above the internal os is often quite free, having no connection whatever with the decidua, or at most is only covered by very slight remains of the reflexa, and that the fœtal membranes possess sufficient elasticity to allow them to be forced down into the cervical canal in an attenuated condition, indeed even as far as the vagina, without the portion which is driven down necessarily separating the remaining and larger portion of the membranes from the decidua vera.

According as the internal os opens up, or merely an expansion of the parietal segment of the body lying immediately above it, takes place, will the internal os in pregnant women—meaning by that the passage from the cervical canal into the uterine *cavity*—be found below the boundary between decidua and cervical mucous membrane, or coinciding with this boundary. If situated below the boundary, *i.e.* in the first case, it is usual to find at the spot where the opening up of the canal ceases, a marked thickening and swelling of the cervical mucous membrane—the so-called ring of Müller; when the opening up does not take place, this naturally coincides with the anatomical internal os, *i.e.* with the upper edge of the cervical mucous membrane. In the first case the lower end of the ovum is not connected with the decidua vera, but lies in contact with the cervical mucous membrane; in the latter case it is so connected, with the exception perhaps of a very small area lying over the internal os. Lastly it must be noticed that sometimes the upper boundary of the cervical mucous membrane is not so sharply defined as usual, and that prolongations of the arbor vitæ may stretch for a short distance beyond the internal os, especially in uteri which have already been pregnant, and whose cervix has therefore been greatly stretched; and that moreover the decidua at the area of expansion (lower uterine segment) may be compressed and flattened owing to this tension, and its characteristic structure therefore be less distinct.

These facts have no doubt led to the contradictory interpretations, which have been put upon the appearances met with.

§ 70. The *position and direction of the cervix* is but little altered during the earlier months of pregnancy. After the fourth month, it is usually directed somewhat further backwards as a result of the forward inclination of the body of the uterus, and rests mainly on the posterior vaginal wall. As the body of the uterus gradually ascends, the cervix is drawn up with it and lies either in the line of the axis of the body, that is, far back in the neighbourhood of the upper sacral vertebræ, the os being directed backwards and downwards, and (owing to the deviation of the fundus to the right) somewhat towards the left side; or the cervical canal becomes horizontal, with the os looking directly backwards (fig. 20), owing to the anterior uterine wall being pushed down; or again it may be bent forwards at an angle with the lower segment of the uterus, so that the external os is directed towards the anterior wall of the vagina, the internal towards the sacrum (fig. 21).

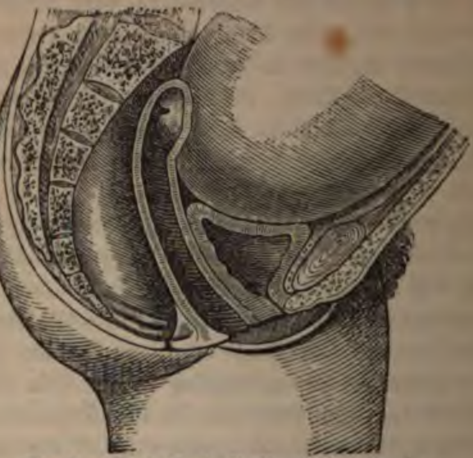
Fig. 20.—Portio Vaginalis directed backwards.

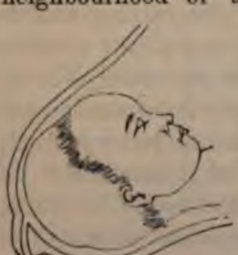
Fig. 21.—Portio Vaginalis directed forwards.

(2) *Vagina and Uterine Appendages.*

§ 71. The alterations in the *vagina* are analogous to those in the uterus. The vaginal walls increase in thickness, the vessels and especially the venous plexuses surrounding the canal, become widened, the secretion more abundant. The hypertrophy of the muscular coat is most marked in the upper half, where it is connected with the uterus. The mucous membrane becomes thicker, and its superficial area increases; indeed not only is the vaginal canal lengthened in an upward direction, when the uterus begins to ascend out of the small pelvis, but it increases in width also, becomes more spongy, and the mucous membrane forms broad thick soft folds, projecting into the lumen. Especially is this true of the anterior wall, in the lower portion of which the urethral thickening becomes very distinct, while in the upper the fundus of the vagina is thrown into thick folds, and even hangs down like a pouch. Not uncommonly moreover the anterior vaginal *cul de sac* seems to be effaced, being transformed into a broad surface, passing horizontally towards the cervix which is directed backwards. As a result of this nutritive activity the small rugæ and (about the middle of pregnancy) papillæ of the mucous membrane grow larger, the latter feel coarse and granular, and especially in the vaginal fornix are often so closely set that the whole mucous membrane feels rough like a grater (hypertrophy of the papillæ, *vaginitis granularis* of older authors). The dark blue tint which characterises the whole canal, from the portio vaginalis to the vulva, is produced by the dilatation and hyperæmia or even engorged state of the venous plexuses.

The *external generative parts* become turgescent and infiltrated like the vagina. They appear tenser and darker, and their mucous aspect is often covered by varicose veins and venous plexuses; their follicles secrete more abundantly; the labia majora gape, causing the vaginal orifice to become wider.

§ 72. The *round ligaments* attain to four times their previous thickness, and increase in length in proportion to the ascent of the uterus; the quantity both of smooth and of striped muscular fibres is augmented (*cf.* § 44), the latter forming a muscle 3 mm. (·15 in.) thick, running from the lower end of the upper third of the ligament to the inguinal ring. The uterine origin of the ligaments moves further forwards, in consequence of the relatively great development of the posterior uterine wall; their course is directed downwards owing to the ascent of the uterus, and they can therefore, especially when their muscular fibres contract, draw the fundus somewhat downwards and forwards.

The *oviducts,* whose parietes share in the general hypertrophy, increase somewhat in width, their course becomes almost vertical, and they no longer arise from the upper angle of the uterus, but from the end of its upper third. The *ovaries* are approximated to the uterus, their previously transverse diameter having become almost vertical; their size also is increased in consequence of the nutritive activity, and of the greater development of the corpus luteum in them. On the other hand the periodical activity, *i.e.* ovulation, with which is associated *menstruation* and the formation of a fresh decidua, ceases. Only in rare cases does such a loss of blood recur once or more times after conception has taken place, and then it is usually slight and irregular; a few instances are on record in which women are said to have menstruated only during pregnancy (?). Such losses of blood, if menstrual, are difficult to account for, since ovulation has so far not been shown to occur during pregnancy. It is possible that menstrual congestion may occasionally persist during the first months, but the majority at any rate of such losses are pathological; frequently the blood is derived not from the cavity of the uterus, but from erosions and varices of the cervical vessels.

The *broad ligaments* are not opened up by the growing uterus, but their parenchyma increases in quantity and succulence; their lymph channels become wider and sacculated, for the more active metabolism which occurs in the pregnant uterus, requires increased facilities for getting rid of waste products. The position and direction of the ligaments are altered as the uterus ascends, their internal extremity being placed higher and having a greater inclination downwards. The same increased swelling and copious infiltration affect the whole *pelvic connective tissue;* it is noticed even at the *pelvic joints,* and at any rate affects their fibrous capsules and the amount of synovial fluid. Lastly, the hips, the lumbar and pubic regions are everywhere affected by these changes; they grow larger (fat), appear broader and fuller.

(3) *Breasts.*

§ 73. The breasts are not fully developed till pregnancy, and become functional at its termination. The changes in them consist mainly in an increase of the secreting surface, due to a budding and proliferation of the acini (*i.e.* the epithelium), with swelling and infiltration of the interlobular connective tissue, and in a greater accumulation of fat between the lobes. The acini themselves are filled with the vacuolelike structures described in § 57, with fat globules, and leucocytes which have undergone fatty degeneration. Thus their volume, their structure and consistence are changed. Even in the first months the glands grow larger, firmer and more sensitive; the pregnant woman complains of momentary throbs in them, and of pains running to the axilla. Inasmuch as the changes described do not affect the whole gland at once, separate knotty cords can be felt, especially in the periphery, the process of development advancing from it towards the centre. With increasing development, milk, or at least a turbid, sometimes thick, sometimes rather serous fluid may be squeezed out, or trickles out spontaneously; the distended superficial veins appear as bluish lines through the skin. At the circumference the cutis gives way in places, producing small bluish-white or reddish lines (striæ).

The *nipple* lengthens, its areola projects more above the neighbouring part of the breast, sometimes like a flattened cone; it appears swelled, shiny and as if slightly emphysematous. Moreover both it and the nipple become more sensitive to touch; they readily contract and pucker, owing to an increase in their muscular fibres, while the nipple becomes at the same time erect and pointed. The areola assumes a deeper tint owing to an increase of pigment, and, especially in brunettes, may become dark or even brownish-black. The pigmentation at the same time extends peripherally, and as it often does so in a radiating manner, there appear in the neighbourhood of the areola, white round spots alternating with dark ones (mostly corresponding to sebaceous glands with unpigmented covering); occasionally they are arranged regularly in a circle or a semicircle, and then chiefly at the upper border of the areola (*secondary areola*, Dubois). Finally even the sebaceous follicles of the areola undergo a marked development, and form a wide or narrow circle of 10—20 small nodules 2—3 mm. (·1—1·5 in.) high, round the nipple (Roederer, Montgomery, *cf.* § 57).

These changes in the breasts are not always developed to the extent mentioned; especially in the areola do the appearances show numerous gradations.

(4) *Organs in the Vicinity of the Uterus.*

§ 74. The great development of the uterus has a disturbing influence on the neighbouring organs, which is mainly of a mechanical nature, but in part due to the hyperæmia which extends to those organs.

The mechanical disturbances which are caused by an increased pressure against the pelvic brim, are not so much the direct result—if we except the cases in which the presenting part of the embryo enters unusually early into the pelvis—of the weight of the pregnant uterus, as of the general rise of intra-abdominal pressure, consequent upon the increased dimensions of the uterus. For even when this organ is filled with liquor amnii, forming a sac with flaccid walls and fluid contents, it does not weigh more than an equal quantity of free abdominal fluid, and the pressure of the latter is not much greater than that exerted by the normal contents of the abdomen. It must further be borne in mind that both the normal contents of the abdomen and the accumulation of fluid referred to influence the shape of the abdomen in exactly the same way, and have therefore an equal mechanical value, and lastly that the specific gravity of the uterus with its contents is almost the same as that of the ordinary contents of the abdomen[1].

The *bladder* is more irritable, and the desire for its evacuation more frequent; sometimes its capacity is diminished owing to the uterus lying in contact with the bladder and therefore making its complete distention difficult. In other cases incontinence results from the diminished capacity, or because when the anterior vaginal wall is drawn up by the uterus, it drags on the neck of the bladder. Retentio urinæ belongs mainly to the last weeks, in which the presenting part of the child presses the neck of the bladder against the symphysis. The coats of the *urethra* appear

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[1] Lahs, *Theorie der Geburt*, 1877.

kened, its lumen is wider, and the edges of the orifice are
llen and deeply injected.

onstipation, when present, usually dates from a period ante-
ent to pregnancy; during the latter however it is often more
tinate, not so much on account of pressure on the rectum as
ng to sluggish peristaltic movements, and to interference with
usual action of the abdominal pressure.

ressure on the *nerve trunks* and *plexuses* of the abdominal
ity during the last months, renders progression difficult,
ses deafness, and leads to occasional cramps in one or both
. It interferes with the circulation, giving rise to *œdema*
varices of the *thighs, external generative organs* and *rectum.*
owever these latter phenomena occur at an earlier period,
h pressure cannot be looked upon as ætiological. Very early
ma and varices are doubtless consequent upon a slowing of
venous flow in the legs, which again is due to the dilatation
he pelvic veins, which accompanies the commencement of
gnancy, and to the rise of intra-abdominal pressure already
tioned; for these reasons such œdema and varices disappear,
t any rate become much less, when the pressure is dimi-
ed by rest in the horizontal position.

75. From the third month onwards, the *abdominal walls* are
e and more stretched by the ascending uterus; nevertheless
, and especially the subcutaneous adipose layer in them,
considerably thicker. It is owing to this that the supra-
cular layer is not thinned in spite of the stretching, and that
n be lifted up in thick broad folds. The hypochondria very
begin to look wider, the circumference of the waist increases,
umbilical depression disappears, and finally is replaced by a
ninence, which is either globular or covered with loose folds,
can be still more drawn out with the fingers. It is not
ys however that the abdominal walls appear to be thickened;
asted and badly nourished persons they are frequently thin,
in multiparæ discoloured and flaccid; the recti are very apt
iverge from each other in such cases.

s a consequence of the cutis being put on the stretch, its
us fasciculi are pulled asunder in various places, and thus
produced changes and tears in the cutis. The latter form
so-called cicatrices (*striæ*) of the abdominal skin, consisting
eddish translucent often bluish-white, now and then pig-

mented short streaks, which retain a pale, white colour after parturition, and may be found as such in a subsequent pregnancy. In these streaks the fibrous fasciculi of the cutis, which normally form rhomboid meshes crossing each other, are differently arranged; they run transversely across the so-called cicatrix, and parallel with one another. In the case of small striæ the papillæ also are arranged transversely, in larger ones they are further apart, so that only a few appear arranged in rows, and these are very much reduced in size; even the blood-vessels in the "cicatrix" pursue a transverse course. It is thus evident that this alteration has in reality no right to the name "cicatrix", since it is caused by the elasticity of the cutis being overcome by the tension.

The striæ may appear early or late, but are rarely quite absent; in most cases they are not formed till the last third of pregnancy. They are always most numerous where the tension of the skin is greatest, *e.g.* at the sides of the abdomen, especially the lower half, where the cutis is closely connected with the iliac and femoral fasciæ. They run at right angles to the direction of the greatest tension of the skin, and as this in the middle line of the abdomen is transverse, the striæ are there usually parallel to the linea alba; round the umbilicus they form curved lines, since the tension in that neighbourhood is radial and concentric[1]. It is not uncommon to find striæ on the gluteal region, on the anterior and posterior surfaces of the thighs, and on the breasts (§ 73); indeed they are not confined to pregnancy, but may form on the parts mentioned, owing to pathological distentions of the abdomen, and even to a rapid development of the pelvic region during the years of puberty.

The traction to which the attachments of the abdominal muscles to the costal arches are exposed during the latter months, sometimes causes severe pains at the sides; this is commonest on the right, since the usual inclination of the fundus uteri to that side causes it to be most stretched.

A further result of the growth and anterior inclination of the uterus is the displacement of the centre of gravity of the whole body forwards. In order to bring it back to a point vertically over the axis of rotation of the pelvis (which runs horizontally through the hip-joints), and to maintain their balance in the erect posture and not to fall forwards, pregnant women throw their head and especially their shoulders with the dorsal part of the vertebral column backwards, throw the hips somewhat forwards, and thus diminish the inclination of their pelvis. This is especially noticeable in persons of small stature, since their uterus projects further forwards, and the compensating action cannot be spread over a large area; consequently the "proud" gait seen during pregnancy is very noticeable in them, while tall thin women can more easily conceal their condition.

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[1] Krause und Felsenreich, "Die Spannungsverhältnisse der Bauchhaut bei Gravidität." *Archiv. f. Gyn.*, xv., 1880.

B. *In the Organism as a Whole.*

§ 76. To this category belong a great variety of phenomena which are usually exceedingly irregular, but in rare cases follow a definite order; sometimes they last throughout the whole of pregnancy, sometimes they disappear early, sometimes they only show themselves during the later portion. In exceptional instances they appear to be entirely absent, and health does not suffer; most pregnant women however are more or less affected. Up to a certain point these phenomena are physiological, but occasionally they become so severe as to endanger life. We cannot always explain their behaviour satisfactorily, but they most probably depend upon qualitative and quantitive changes in the blood, upon changes in the nervous system due to those in the blood or to the local changes in the sexual organs, and upon a more impressionable condition of the nervous system.

It is an old doctrine that the *quantity* of blood is increased, that a plethora sets in during pregnancy, and there is much to be said *a priori* in favour of such a view. On the one hand so large a quantity of blood is required to fill the temporarily enormously dilated uterine vessels, that, unless the total volume of blood increases, those vessels could only be filled by other organs being rendered partially anæmic; on the other hand Gassner has proved that a greater increase in bulk of the whole body takes place during the last three months of pregnancy, than can be explained by the mere addition of the ovum and the enlarged uterus, and it may fairly be assumed that in this increase the blood, the generally distributed connective tissues and the intercellular fluid participate. Indeed I, in conjunction with Gscheidlen, have shown that such an augmentation in the quantity of blood takes place in dogs, at any rate during the latter half of pregnancy, and a similar change probably occurs in a healthy woman.

Many pregnant women however show symptoms of an impoverished state of blood, and this is not by any means unlikely to be the case, for the researches of French authors (Andral and Gavarret, Becquerel and Rodier, Reignauld), as well as the recent ones of Nasse, have shown that the quantity of red corpuscles and of albumin diminishes, that the white corpuscles, fibrin and water increase, that the serum generally contains less solids, and that this impoverishment is consequent upon the supply of formative matter to the embryo. The increase in the white corpuscles and in the fibrin is due to the fact that in the degree in which the lymphatics of the uterus develop, in which the metabolism in the latter increases and the pelvic and lumbar glands enlarge, more and more lymph corpuscles, and an increasing quantity of a slowly coagulating fibrin are thrown into the blood (leading to the formation of a buffy coat). Hence arises a physiological leukocytosis (Virchow).

The two views, viz. that the blood is increased in quantity, while at the same time its quality is impoverished in important constituents, do not exclude each other; a combination of general hyperæmia and hydræmia, a serous plethora (Kiwisch), is shown by the above-mentioned observations to be probable in many cases. In any one individual, sometimes one feature, sometimes the other will of course be most marked. Perfectly healthy and well nourished persons will either show signs of a full vascular system, or will be quite unaffected; weakly and badly nourished persons, in whom for some reason or other the assimilative processes and the supply of nutriment to the uterus and embryo are not well balanced, will show signs of chlorosis and hydræmia; persons with disorders of the heart or blood-vessels will present a pathological form of anæmia, &c.

Many of the symptoms associated with pregnancy may be explained as consequences of such alterations in the blood; not all of them however, especially not those which appear during the first months; for the alterations in the blood only come on subsequently. The most important symptoms are the following:—

§ 77. Owing to the interposition of the placental circulation between the uterine arteries and veins, and to the already mentioned increase in the volume of blood, more work is thrown upon the *heart*, and as a consequence of this a slight increase, an eccentric hypertrophy of the left ventricle follows. The various *disturbances of the circulation* which are now and then observed in pregnant women, are in part due to this altered relation, for example the frequent palpitation, the early œdema and varices of the legs, the easily induced attacks of vertigo and cerebral congestion, although doubtless pre-existing disorders of the vascular system (hypoplasia), anæmia and nervous irritability are also in part the cause. It is an old observation that the size of the neck is increased by *swelling of thyroid gland*, but true goitre rarely follows, and probably only where a predisposition existed.

On the inner table of the cranial vault, between it and the dura mater, small deposits of new bone are formed, first of all on the frontal, then on the parietal bones, but rarely on the posterior portion of the skull. These deposits, the puerperal *osteophytes* of Rokitansky, lie mainly in the depressions of the skull, preferably along the groove for the middle meningeal artery and along the sulcus falciformis. They form irregular, for the most part elongated plates 2—4 mm. (·1—·2 in.) thick, which adhere more firmly to the bones than to the dura mater, and, as they arise from the former, are more perfectly organised in their deeper layers than in those next the dura mater. In a fresh condition they are reddish-white, when more advanced pale white or pale yellow, and they are composed mainly of carbonate of lime with a rich organic basis. They occur in nearly 50 p. c. of all pregnant women after the 5th month, most of all in young persons, and therefore in primiparæ. Occasionally, and especially where the formation of bone on the inner table is very abundant, they are also met with on the outer table, principally in the posterior part of the skull. What eventually becomes of the osteophytes, whether or not they entirely disappear, is still unsettled. They give rise to no symptoms.

§ 78. The vital capacity of the lungs does not diminish during pregnancy, according to the spirometric researches of Küchenmeister, Fabius and Wintrich (Dohrn however found it to be greater on the 12th to 14th day after parturition, than during the latter weeks of pregnancy). The thoracic cavity therefore is not encroached upon as pregnancy advances (*cf.* § 67), and Gerhardt found the position of the diaphragm in pregnant women to be practically unaltered; he was only able to satisfy himself that the base of the thorax was widened, an observation which Dohrn also corroborated. The researches of the latter show that the base of the thorax is wider than after labour, while the antero-posterior diameter is diminished, a relation which is reversed when the uterus is emptied; only in elderly women do both diameters appear to increase. The alteration in the dimensions discovered by Dohrn, is probably due to the fact that the ascending uterus drags upon the points of insertion of the diaphragm; the whole circumference of the base of the thorax is consequently pulled inwards, while it only yields at its weakest point, viz. the anterior wall, to which the flexible costal cartilages are attached; the sternum recedes, but the lateral curves of the ribs become more marked and arched outwards.

Andral and Gavarret assert that the expired air contains more carbonic acid, just as it does towards the end of menstruation (?).

It is the *digestive system* that usually, especially in the first half of pregnancy, gives rise to the most disagreeable symptoms. Not that the actual processes of digestion and assimilation are upset, for attacks of dyspepsia and slight gastric catarrhs are as a rule only temporary. It is the only too familiar *vomiting*, which is so extremely troublesome. This symptom frequently begins in the morning, when the stomach is empty, but may do so at any hour of the day at which nourishment has been taken; it often sets in immediately after conception, and disappears between the 3rd and 5th months; in other cases it starts later, and lasts longer. In most instances the general health does not suffer, but now and again the vomiting becomes extremely dangerous, owing to its lengthy duration and its onset after every meal. It depends, like the occasional perversions of appetite and the heart-burn, upon a disordered condition of the nervous system. A similar cause must be assigned to the *salivation* which is met with from time to time, but I have only seen two cases in which it had a weakening effect. The salivary secretion itself does not differ from the normal, except in its larger proportion of water.

The spleen increases in size according to the observations of Birch and Hirschfeld (*Berl. Klin. Woch.*, 1878, p. 324), usually reaching the weight of 180 grm. (6¼ oz.), while the ordinary weight is only 140 grm. (5 oz. avoir.).

§ 79. We have spoken above of difficulty in *micturition*. But the *secretion* itself also is frequently altered. In the first place the quantity is greater, the increase however being entirely due to an increased elimination of water, resulting from the increase in the quantity of blood mentioned above, and from the higher pressure in the vascular area supplied by the aorta; the daily excretion of urea, of sodium chloride, of sulphates and probably of phosphates remains unaltered.

Albuminuria is not rare, especially during the last weeks, and at that period is generally due to catarrh of the lower urinary passages; in all other cases its presence must be looked upon as pathological. *Sugar* also has been occasionally found in the urine, and has then (as also when found during suckling) been absorbed from the breasts, constituting a kind of absorption diabetes. If the urine is allowed to stand for some time, an iridescent pellicle very often forms on it; this is the *kiestine* of Nauche, and was formerly regarded as peculiar to pregnancy, and therefore as a pathognomonic sign. Kiestine however is merely a product of decomposition, and composed of a proteid substance, triple phosphates, fungi and infusoria; it is met with quite apart from pregnancy, and also in men.

§ 80. The changes in the *skin* are remarkable and characteristic. Any previous redness frequently disappears, the skin becomes loose and sallow, especially over the face, where dark rings form round the eyes; in other cases the colour becomes more vivid, the face broader and the woman looks uncommonly well. These changes depend in the main on the general state of nutrition. Localised eczemas, stearrhœa, particularly on the face and hairy scalp, are not infrequent appearances.

The pigmentation of the areola increases, and with it fresh *pigmentary deposits* are formed in various regions, especially about the external generative organs, the abdominal walls and the face. Now and then the whole abdomen is uniformly coloured light or dark brown, and then presents a curious contrast with the whiteness of the rest of the body; but as a rule this deposit of pigment only shows itself in isolated irregular spots, and affects especially the linea alba, where it gives rise to a dark brown line 2—7 mm. (·1—·3 in.) wide, running from the mons Veneris to the umbilicus and often as high as the ensiform process. The epigastrium is as a rule less pigmented, but it is generally associated with a brown ring 2—3 cm. (·75—1·25 in.) encircling the navel (umbilical areola, Montgomery).

In the face irregular brown patches appear on the forehead, eyebrows, bridge of the nose, and on the upper lip (chloasma uterinum), and form the so-called "mask" of pregnant women.

These various deposits of pigment are supposed to have as their cause the arrest of the menstrual flow, and the well marked forms are usually seen in very anæmic persons, although varying greatly as regards extent and intensity in different individuals; they are generally most distinct in brunettes, and continue sometimes to increase after delivery, although as a rule they diminish; in rare cases they disappear altogether. They may be so extensively developed, and at the same time so intense that the pregnant woman is quite disfigured and confined to the house[1].

In some cases, especially when the chest is attacked, the pigmentation is due to a fungoid growth, is in fact pityriasis versicolor, and I have generally found this to be the case in weakened and wasted persons.

§ 81. As remarked above, the influence of pregnancy on the *nervous system* generally shows itself in a heightened susceptibility to impressions, in greater excitability, although periods of depression also occur. Every part of the nervous system, the psychical condition (uncertainty of temper, melancholy, disturbed sleep), the acuteness of the senses (amblyopia, hemeralopia, deafness, perversions of taste and smell), the sensory, motor (rarely) and the vaso-motor tracts (attacks of neuralgia, hyperæsthesia, vertigo, syncope; local anæsthesia and paralyses) are affected.

These symptoms may up to a certain point occur within the limits of health, but whether they are due to alterations in the blood or are brought on by changes in the sexual organs (in a reflex manner), is an open question. During the second half of pregnancy, they are as a rule less noticeable, indeed now and then nervous ailments which had previously been very troublesome disappear, when the woman becomes pregnant.

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[1] A good example of this extreme pigmentation is recorded, amongst others, in the *New York Med. J.*, May, 1878, by Dr. M'Lane.

Finally, it is deserving of notice that pregnancy protects from no intercurrent disease which would otherwise supervene, but complicates the course of most of them.

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Section II.

THE EMBRYO, ITS MEMBRANES AND APPENDAGES.

a. The Development of the Ovum.

§ 82. The segmentation of the yolk, which is the first effect of conception, leads to the grouping of the largest number of the segmentation spheres at a point immediately beneath the zona pellucida, and thus to the formation of the *blastodermic vesicle*. At one part of the latter a large number of cells are heaped up and give rise to a thickening of oval or almost circular outline, which plays a direct share in the building up of the embryo, and is called the *embryonic area*. The thickening soon splits into two lamellæ or *blastodermic layers*, an upper and a lower, forming the epiblast and the hypoblast (ectoderm and entoderm, Kölliker), which continue to grow out from the embryonic area, till at last the whole wall of the blastodermic vesicle consists of two concentric layers, lying closely one above the other.

The building up of the embryo now commences in the embryonic area of the blastodermic vesicle, by the lower layer splitting into the conjoined muscle-plate (mesoblast, mesoderm) and into the hypoblast (entoderm), and by the muscle-plate splitting into the somato-pleural or volunto-muscular, and into the splanchno-pleural or involunto-muscular plates (Remak, His, Waldeyer). The *upper* blastodermic or *sensory* layer (epiblast, ectoderm) gives rise to the central nervous system, with its offshoots, the higher sense organs, and to the epithelium of the skin with the glands connected with it; the central nervous system is derived from the median (axial) portion which forms the so-called *medullary plates;* the epithelium of the skin from the peripheral portion or *corneal* layer of the blastodermic vesicle. Moreover the origin of the urogenital organs, especially the sexual glands, is to be referred to the upper layer and to the axis-cord (*i.e.* the elongated mass due to cell proliferation which is formed in the axis of the transparent embryonic area), in which no division into separate layers can be made out. From the *middle* layer or *muscle-plates* (mesoblast, mesoderm) are formed the connective tissues, the muscular and the vascular systems, *i.e.* the main bulk of the organism. The *somato-pleural* muscular layer forms the body wall; the *splanchno-pleural* layer, the intestinal wall, with the exception of the epithelium, and the heart. The fissure remaining between the two layers becomes the pleuro-peritoneal cavity, but inasmuch as the fissure does not reach the middle line, there remains at that point a connection between the abdominal and intestinal walls, which leads to the formation of the mesentery. From the *hypoblast*, or *lowest* blastodermic layer, arise (through the epithelium forming diverticula which project into the splanchno-pleural muscular lamella) the small glands of the digestive canal, the large glands opening into it (liver, pancreas), the lungs and the kidneys; but as the splanchno-pleural muscular lamella is itself involuted during the development of these glands, and made to encroach upon the pleuro-peritoneal cavity, all those organs that have been mentioned, come to lie in it.

§ 83. Soon after the walls of the embryo have begun to split into distinct layers, the embryo raises itself (by a process of constriction) above the remaining or *peripheral* portion of the blastodermic vesicle, as an elongated tube which remains widely open on its lower aspect; at the same time both ends of the embryo curve downwards towards the cavity of the vesicle, so as to give it more or less the shape of a canoe. The portion of the blastodermic vesicle which is constricted off (fig. 22), is termed the *umbilical vesicle* (*yolk-sac*); and the opening by which it communicates with the cavity of the embryo (and which gradually

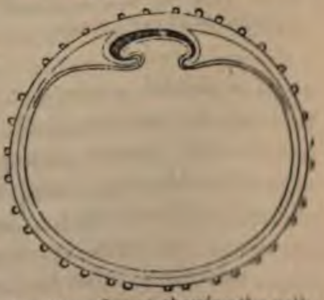

Fig. 22.—Ovum, showing the yolk-sac and the amnion in process of development.
(After Kölliker.)

narrows as constriction proceeds), remains as the *vitello-intestinal* or *omphalo-enteric* duct. At last there merely remains a ring-like constricting fold, the *navel;* and inasmuch as the walls of the blastodermic vesicle continue to form two layers, for some distance beyond the constriction, *i.e.* at their peripheral portion, the umbilical wall also consists of several layers.

§ 84. While the body-cavity is being formed and subsequently also, the embryo sinks into a depressed portion of the embryonic area, and thus becomes shut in on all sides by a kind of embankment. Along the margin of the embryonic area, the hypoblast and the splanchno-pleural muscular layer diverge from the epiblast and the somato-pleural muscular layer, with which they were in contact, first of all at the cephalic, then also at the caudal extremity and at the sides. The epiblastic layer and the somato-pleural muscular lamella become more and more prominent, and at the head, tail and sides form folds (the *cephalic, caudal and lateral folds*), which grow up all round and meet above the dorsum of the embryo, finally uniting over it to form a sac (figs. 22 and 23). As soon as the folds of the amnion have coalesced, the two layers of which they consist separate, the inner one giving rise to the *amnion* proper, the outer one forming with the remaining portion of the upper layer of the blastodermic vesicle a completely closed vesicle, which comes into contact with the zona pellucida. This constitutes the *subzonal* membrane of the ovum, which therefore consists only of the epiblast (or rather its continuation over the peripheral portion of the

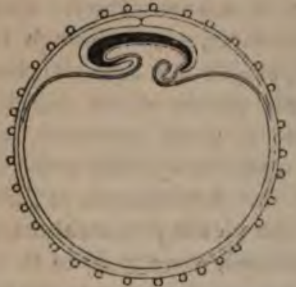

Fig. 23.—Ovum, showing the amniotic folds about to coalesce, and the allantois at an early stage.

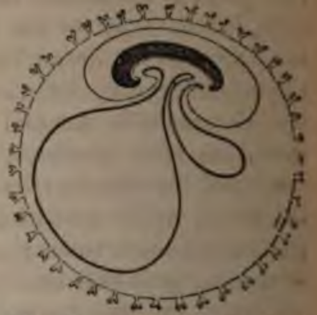

Fig. 24.—Ovum, showing the subzonal membrane covered with villi, and the allantois which has undergone further development.

blastodermic vesicle), and eventually forms the *chorion* (figs. 23 and 24). At first the amnion lies close to the embryo, but soon a liquid, the liquor amnii, is thrown out between them, which distends the amniotic cavity, and surrounds the embryo on all sides.

§ 85. At the time that the amniotic folds coalesce, there appear at the posterior extremity of the embryo at the edge of the opening into the hind-gut, two solid aggregations of cells, which soon blend with each other; into this pyriform outgrowth a diverticulum of the hind-gut projects, in consequence of which it becomes excavated, and forms a vesicle. This is the rudiment of the *allantois*.

This vesicle grows rapidly between the somatic and the splanchnic muscle-plates, through the integumental portion of the navel out of the embryo, and thus comes to lie between the amnion and the blastodermic vesicle (fig. 24); it grows round the former, and becomes applied to the subzonal membrane of the ovum, *i.e.* to the chorion. The point of connection between the hind-gut and the allantois is called the *cloaca*, from which the *urinary bladder* is developed; the narrower portion which passes through the integumental portion of the umbilicus, *i.e.* the peduncle of the allantois, goes to form the urachus. When the allantoic vesicle has reached the chorion, the largest branches of the aortæ run in it; these are called the *umbilical arteries*, and their terminal loops project into the chorionic villi; the vessels that return from the latter unite to form the single *umbilical vein*, which runs to the navel with the arteries, passes through it back into the embryo, and communicates with the hepatic vessels and with the inferior vena cava. At the point where the allantoic vessels penetrate into the chorionic villi, the latter undergo great development, and become intimately connected with the mucous membrane of the uterus; the capillaries of the latter also develop over a corresponding area, and thus is formed the *placenta* which constitutes the direct connection between mother and embryo.

§ 86. By the commencement of the fourth week, therefore in a very short period, the foundation, so to speak, of the main structure of the now 4·5—6 mm. (·2—·3 in.) long embryo is completed. The latter is shut off by the amnion from the peripheral portions of the ovum, its body-cavity being closed, with the exception of the umbilical opening (fig. 25). The embryo is connected with the distal parts of the ovum merely by the *umbilical cord*, which at first contains also the pedicle of the umbilical vesicle or yolk-sac, the omphalo-enteric duct with the omphalo-mesenteric vessels and the pedicle of the allantois with the umbilical vessels, but later on only the latter with the connective tissue supporting them, and is enclosed by a sheath of amnion.

The *umbilical vesicle*, lying between the amnion and the chorion (fig. 25), soon atrophies together with the umbilical duct and its vessels; it can however almost always be found even in the mature placenta as a small whitish vesicle, lying between the two embryonic membranes. Moreover a small cord, the omphalo-enteric duct, runs in the umbilical cord to the little vesicle and occasionally an omphalo-mesenteric vessel is also preserved[1].

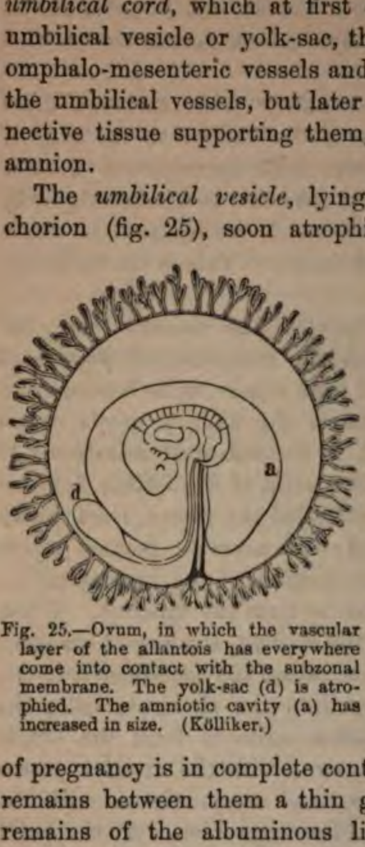

Fig. 25.—Ovum, in which the vascular layer of the allantois has everywhere come into contact with the subzonal membrane. The yolk-sac (d) is atrophied. The amniotic cavity (a) has increased in size. (Kölliker.)

§ 87. Between the amnion and chorion there is at first a considerable space; but the former soon begins to grow rapidly and by the third month of pregnancy is in complete contact with the latter, though there remains between them a thin gelatinous layer, the inspissated remains of the albuminous liquid that previously separated them. The ovum as a whole however is becoming surrounded by a membrane derived from the uterine mucous membrane, the *decidua reflexa* (fig. 26, *dr.*), which at the point of attachment of the ovum is continuous with and attached to the inner surface of the uterus, *i.e.* to the *decidua vera* (*dv.*). Up to the third month the ovum and the uterine walls are still separated by a small interval, filled with mucus, which disappears with the further growth of the ovum, by the reflexa coming into contact with the vera. From this time onwards the membranes enclosing the embryo merely form separate layers of a single sac.

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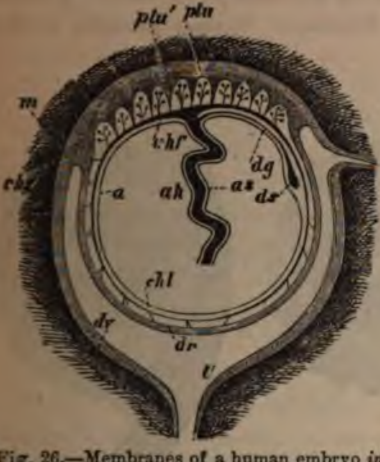
[1] The small *umbilical vesicle* usually lies at the edge of the placenta, but frequently lower down, and sometimes at the opposite pole of the ovum. Its length is 3—10 mm. (1·5—·4 in.), its shape pyriform, round or oval; it contains a whitish-yellow turbid substance, consisting of fat and carbonates. The *vitelline duct*, *i.e.* the pedicle of the umbilical vesicle, is best preserved in the neighbourhood of the latter, but sometimes may be followed as far as the umbilical cord. Not uncommonly it presents numerous local dilatations filled with yolk matter (?). In passing from the embryonic membranes into the umbilical cord, it sometimes raises the amnion into a fold (fold of Schultze). The *vessels of the umbilical vesicle* appear as white threads, running along the vitelline duct at a variable distance from it; it is most frequently met with in monstrosities; the vein is usually persistent. According to Ruge (*Zeitschrift f. Geb. u. Gyn.*, i.) an absence of coils in the umbilical cord is associated with a persistence of the vessels. In the abdominal cavity the vitelline duct passes to the intestine, the blood-vessel to the mesentery. (*cf.* Ahlfeld, *Arch. f. Gynäk.*, xi., pp. 184, 589.)



m. muscularis of the uterus, only partially shown. *dv.* decidua vera. *plu.* placenta uterina, external layer. *plu'.* internal layer of the same with prolongations between the chorionic villi., *chz.* *dr.* decidua reflexa. *chl.* chorion læve. *chf.* chorion frondosum, which, together with the villi *chv.* constitutes the fœtal placenta. *a.* amnion. *ah.* amniotic cavity. *as.* amniotic sheath round the umbilical cord. *vd.* vitelline duct. *ys.* yolk-sac. *U.* cavity of the uterus (drawn too large).

Fig. 26.—Membranes of a human embryo *in situ*; represented diagrammatically. (After Kölliker.)

The mature ovum consists therefore of the *embryo* (called *fœtus* after the third month), and its *appendages*—the amnion with the liquor amnii, the chorion and the decidua, together with the placenta and the umbilical cord.

b. The Fœtal Appendages.

(1) *Decidua.*

§ 88. We have already in § 64 mentioned the great development of the uterine mucous membrane, which begins with conception, and consists of a marked increase in the hypertrophy which accompanied the last ovulation. This increase in size depends on considerable enlargement of the test-tube uterine glands, on abundant new formation of connective tissue, on the appearance of numerous migrating cells and on great development of the vessels; the epithelium is for the most part lost, as in menstruation.

By the second week the mucous membrane has reached a thickness of 4—6 mm. (·15—·2 in.), is more easily definable from the subjacent muscular coat, is soft, spongy and dark red, its surface being raised into small distinct folds and pierced sievelike by the dilated mouths of the uterine glands. This is the *decidua vera* (*decidua*, W. Hunter). It ends abruptly at the internal os, and leaves the openings of the Fallopian tubes free. The ovum on entering the uterine cavity is detained in its upper portion, owing to that cavity being almost entirely filled up by the swollen mucous membrane. It finds a nidus and embeds itself in the folds of mucous membrane, which very soon (figs. 27—29) sprout up all round the ovum, and at last close in above it to form a complete sac; they are called *decidua reflexa* (owing to the earlier view that the openings of the Fallopian tube were closed by the decidua vera, which was looked upon as an exudation which the ovum was obliged to push before it), the portion of the decidua vera to which the ovum remains attached,

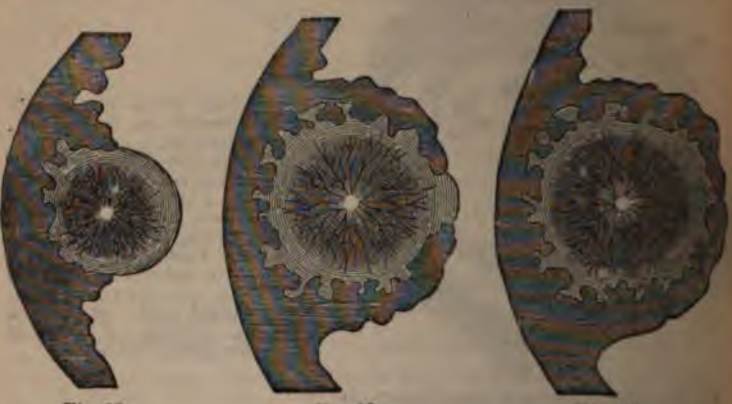


Fig. 27. Fig. 28. Fig. 29.

Ovum becoming embedded in the decidua, and reflexa in process of development (diagrammatic).

being called the *decidua serotina*. At first the decidua vera is separated by mucus (*cf. supra*) from the reflexa, but before long the latter is rapidly stretched by the ovum, and in the third month comes to lie in close contact with the vera; thereupon both become blended into a single membrane, which as a rule can only with difficulty and in isolated places be separated into its original constituents.

§ 89. A healthy decidua vera has about the third month a thickness of 4—7 mm. (·2—·3 in.), but soon afterwards begins to grow thinner. It consists of large spherical and elongated cells with a large nucleus and somewhat granular contents, which are derived from the connective tissue cells and from the endothelium of the uterine mucous membrane (*decidual cells* of Friedländer). The spherical cells are most abundant in the inner, the spindle cells derived from them in the outer layer; their finely granular, otherwise homogeneous intercellular substance is very small in quantity, and gradually decreases towards the chorion; between the separate cells lie numerous lymph corpuscles, indeed Leopold regards the whole mucous membrane as an enormous extent of connected lymph spaces. The blood-vessels are numerous; on the inner surface, especially during the first half of pregnancy, numerous plexuses are found, and

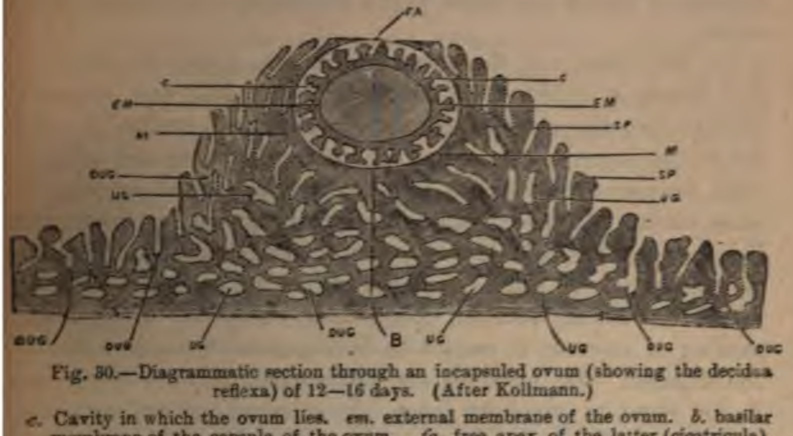


Fig. 30.—Diagrammatic section through an incapsuled ovum (showing the decidua reflexa) of 12—16 days. (After Kollmann.)

c. Cavity in which the ovum lies. *em*. external membrane of the ovum. *b*. basilar membrane of the capsule of the ovum. *fa*. free apex of the latter (cicatricula), devoid of glands. *m*. marginal zone of the embryonic capsule. *s*. submucosa. *sp*. secondary papillæ, *i.e.* slight elevations of the decidua, between the orifices of the glands. *dug*. ducts of the uterine glands. *ug*. dilated alveoli of the uterine glands (cut across).

amongst them are wide venous sinuses, which are best developed at the point where the decidua vera is continued into the reflexa, and there open into the marginal sinus of the placenta. The walls of the blood-vessels consist merely of an endothelial lining, their remaining elements being used up during the formation of connective tissue cells in the neighbouring tissue. The whole of this tissue is perforated by the vertically arranged glands, which like the blood-vessels lie in lymph spaces (Leopold). The glands are best developed in the most external layers of the decidua; they are often divided, filled in this region with cubical or cylindrical epithelium, and supported by a slight amount of connective tissue with a fibrillated intercellular substance.

As the uterus and the ovum continue to grow, the decidua vera becomes stretched in length and breadth, and thinned accordingly; the constituents already described gradually give rise to two layers, an inner and an outer. The inner or *cellular layer* consists mainly of the large cells with a small amount of intercellular substance, which however is almost lost near the inner surface; the spindle cells amongst them support the vessels. The ducts of the glands are opened out or obliterated, their epithelium having entirely disappeared, except for a few fragments; at any rate it cannot be distinguished from the cells of the decidua. Fat granules are interspersed between the cells. In the outer or *glandular layer*, the enlarged but yet perfectly distinct glands predominate. The intervening tissue shows fewer and smaller cells, the spindle-shaped being most numerous; fat granules are absent; the connective tissue lamellæ are fibrillary and abundantly supplied with lymph corpuscles. At the point where the cellular passes into the glandular layer, the latter presents a very strong areolar texture and large flattened gland spaces, lined partly with squamous, partly with cylindrical epithelium, or else empty; it has been well named the ampullary layer.

At delivery it is only the cellular layer that is shed; the glandular layer remains behind. The line of separation generally passes through the ampullary layer, though instances in which small portions of the cellular layer remain adherent, or in which rather much of the glandular layer has been thrown off, will of course occasionally occur. The thickness of the decidua in the expelled ovum is therefore slight, and not uncommonly only a very thin layer or shreds of it are found attached to the chorion; this layer is always thickest near the placenta[1].

The *decidua reflexa* is smooth on its outer surface, but has a pitted and cancellous appearance on the inner, which looks towards the ovum and is connected with the chorionic villi. It resembles the vera in being composed of large cells with but little intercellular substance; but the cells are much more flattened, spindle-shaped and polygonal. By the middle of pregnancy, the reflexa has lost its vessels, the epithelium also is missing, and about this time the mouths of the ducts disappear; at most can the latter still be found near the point of reflection on to the vera, where also some enlarged gland ducts are met with. On the other hand the fatty degeneration of the cells takes place earlier and more extensively than in the vera. Indeed sometimes, although it is not the rule, the whole reflexa is near the end of pregnancy transformed into a fatty detritus; moreover the fatty degeneration increases regularly with the distance from the edge of the placenta. When in the expelled ovum the two deciduæ can still be separated, they may be easily distinguished by their colour; the reflexa is whitish (non-vascular), the vera red.

(2) *Chorion.*

§ 90. The chorion or external embryonic membrane lies next and on the inner side of the decidua, and forms a thin areolar non-vascular membrane, which may without much difficulty be detached from the reflexa. At the commencement of development the external covering of the ovum consists of the zona pellucida, on which small structureless villi have formed; this *primitive villous membrane* (Kölliker) disappears later on, in order to make room for the *secondary* or *permanent chorion*. The latter consists of an outer epithelial layer (exochorion) derived from the subzonal coat of the ovum (*cf.* above), and of an inner connective tissue originally vascular layer (endochorion), which is formed by the external connective tissue coat of the allantois, and by the umbilical vessels; this last layer shows stellate and spindle-shaped cells and gradually becomes more and more fibrous. On the outer layer cellular projections soon appear, which at first are solid, but subsequently become hollow; these are the *chorionic villi*, and into them the umbilical vessels together with their supporting connective tissue penetrate; the villi themselves sink into the serotina and the reflexa. Up to the end of the second month all the constituents of the chorion continue to grow; it has a mosslike appearance and is called the *chorion frondosum*. When this stage has been reached, that is during the third month, the villi become larger at the part which corresponds to the serotina or future seat of the placenta; everywhere else their growth is retarded, and in consequence of the pressure exerted on the surface of the ovum by the uterine wall which closely embraces it, they dwindle and their vessels atrophy. Over the whole surface of the ovum with the exception of the placental area, the chorion appears as a thin membrane covered with epithelium, to which membrane only a few small whitish filiform non-vascular projections adhere as remnants of the villi (*chorion læve*). The atrophied villi are most numerous in the neighbourhood of the placenta.

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[1] According to Ahlfeld (*Centralbl. f. Gyn.*, No. 10, 1878), the degree of maturity of the ovum may be ascertained from the structure of the decidua. The younger the ovum, the larger and the more filled with blood will the blood-vessels found on the decidua be; the older, the smaller are the vessels that still contain blood; in the mature ovum such vessels are entirely absent, or at most one or two are found here and there, especially in the neighbourhood of the placenta; in such cases also the decidua has a much lighter, a yellowish-white colour.

A *chorionic villus*, when fully developed, consists of a connective tissue core, of the fœtal vessels lying in it (loops and capillary net-work) and of an epithelial lining, the sheath of the villus. The cells of the latter are somewhat small, rounded, except at their outer end, where they are angular, and drawn out in the direction of their length; they contain a large nucleus with hyaline or finely granular protoplasm. In the mucous tissue of the stem occur elongated stellate cells, whose processes reach to the epithelial cells as well as to the capillaries; small lymphatics are certainly present.

(3) *Amnion.*

§ 91. The amnion is in close contact with inner surface of the chorion (§ 84), although easily separable from it. It presents a thin translucent non-vascular membrane, which is tougher and more elastic than the chorion. It possesses on its inner (fœtal) surface a simple epithelium formed of small short cylindrical or squamous cells. Between the cells are found (especially at the placental portion) small bright sharply defined nucleated spherules; stomata also are said to be present. The outer connective tissue layer of the amnion is seen immediately beneath the epithelium to be homogeneous, further outwards to be faintly striated, with elongated and stellate cells, whose processes communicate with those of neighbouring cells, and there form a net-work of thin-walled channels; these channels stretch through the homogeneous layer to the epithelium, and are said at the other side to be connected with similar channels in the chorion (Winogradow); they are serous channels. At an advanced stage of pregnancy, those cells have almost always undergone fatty degeneration. At the placental portion of the amnion and at the end of the umbilical cord corresponding to it, are sometimes found aggregations of epithelium of a flattened, hemispherical or papillary shape, which are analogous to the amniotic caruncles found in many animals, especially in the ruminants, and are probably unimportant (*cf.* my observations in the *Monatsschrift f. Geburtsh.*, xxiii., p. 226).

At the point where the umbilical cord is inserted into the placenta, the amnion is continued on to the former, constituting its sheath; the connective tissue layer passes into the parenchyma of the cord. At the navel the epithelium and connective tissue are continued into the epidermis and cutis of the embryo, a fact which accords with the mode of development of the amnion (§ 84). It has been already remarked (*cf.* § 87) that the stringy gelatinous tissue (*tunica media* of Bischoff), which connects amnion and chorion, is an inspissated albuminous fluid without definite structural elements. Sometimes however it remains more limpid, and if so may during labour be driven into the end of the ovum which is forcing itself through the os uteri, in a quantity varying from a table-spoon to a small cupfull; it may separate the chorion from the amnion, so that two concentric embryonic sacs are formed, an outer chorionic and an inner amniotic sac, the interspace between them being occupied by the *amnio-chorionic* fluid, a "spurious" liquor amnii.

(4) *Liquor amnii.*

§ 92. The *liquor amnii* is a clear yellowish-green liquid with a fleshy odour, and in which some small white particles (cast off epidermic scales and fragments of fœtal vernix caseosa) and woolly hairs are suspended; in rare cases it is discoloured and has an offensive odour even with a living child, but when this is so the uterine mucous membrane is generally diseased. The quantity averages ·5—1 kilo. (1—2 pints), but varies greatly, and the extremes are of importance. During the first half of gestation the quantity is greater in proportion to the size of the embryo than in the second half, though the actual volume generally continues to increase on to the end. The liquor amnii is alkaline, and has a low specific gravity, lower than that of the fœtus and of the umbilical cord (1002—1028); during the later months it becomes still less concentrated, and in its general character resembles diluted blood-serum. It always contains albumin, derivatives from it, kreatinin, various salts and almost always urea, especially during the later months[1]. The urea is unquestionably derived from the kidneys of the fœtus and not from its tissues, nor from the maternal blood (in cases of imperforate urethra the urine accumulates in the bladder, and distends it enormously); and this view readily explains why, supposing the fœtus to evacuate urine only at intervals, the amount of urea in the liquor amnii should vary, and why it should increase towards the end of pregnancy, when more urine is secreted. A portion of the urea passes back into the maternal circulation, either directly or after undergoing decomposition.

The liquor amnii is formed by the fœtus; this is proved by oviparous animals which possess both amnion and liquor amnii. The sources are, first the skin, secondly the capillaries or vasa propria of the superficial layer of the placenta (*i.e.* the membrane which lies immediately beneath the amnion and is derived from the chorion), communicate with the vessels of the umbilical cord; these capillaries, under the influence of the fœtal blood-pressure, pour the fluid into the amniotic cavity. Since however the capillary system just mentioned usually becomes more and more attenuated during the last months of pregnancy, while the absolute volume of the amniotic fluid increases, we must to

[1] Scherer found that the liquor amnii contained in the 5th month 7·67 p.m. of albumin, 7·24 of extractives, and 9·25 of salts, with 975·84 of water; in the 10th month ·82 of albumin, ·60 of extractives, and 7·06 of salts, with 991·5 of water. In a pregnant woman who died from phthisis at the 6th month, and on whom gastrotomy was immediately performed, I found that the carefully collected liquor amnii contained 1·4 p.m. of albumin, 4·2 of albumin derivatives, 3·6 of urea, 7·95 of salts.

explain the latter phenomenon, look upon the kidneys as a third source of liquor amnii in addition to the cutaneous capillaries. This will account for the liquor amnii becoming more dilute during the last months, especially for the albumin diminishing, as well as for the fact that when the fœtal urinary passages are occluded, or when the kidneys are absent, the quantity of liquor amnii is almost always extremely small; numerous instances of this condition have been published, and I myself have twice observed it (where the kidneys were absent). In accepting this view of the origin of the liquor amnii, the possibility of the uterus participating in its formation is by no means excluded, and several pathological phenomena seem to indicate such a possibility; in reference to this point the great vascularity of the decidua vera is especially important, for it is quite conceivable that the vera might, after blending with the reflexa, cause an effusion of fluid into the amniotic cavity[1].

The chief use of the liquor amnii lies in maintaining the shape and distention of the amniotic cavity, in preventing any of the mechanical shocks which affect the mother from being transmitted to the fœtus, in preventing adhesions between different parts of the fœtus, in preventing any compression of the umbilical cord and placenta, in facilitating the movements of the fœtus, and in rendering them less perceptible to the mother. During parturition the liquor amnii materially assists in the uninterrupted dilatation of the cervix by driving the fœtal membranes through it in the form of a bladder, and, after it has been discharged, leaves the parturient canal in a slippery condition.

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[1] Gusserow is the most strenuous advocate for the participation of the kidneys in secreting the liquor amnii; Fehling, Ahlfeld, and others (*cf.* literature) hold an opposite opinion. In spite of some objections that may be raised against the facts and arguments which have been brought forward in so convincing a manner by Gusserow, yet the constant presence of urea in the liquor amnii, and indeed in larger proportion than exists in the maternal blood, while urea is absent from the body of the fœtus, as well as the accumulation of urine in the bladder and ureters when the urinary passages are imperforate in much greater quantities than are ever found in a well formed child, are facts which point clearly to the secretion and discharge of urine into the amniotic cavity. These demonstrated facts cannot be set aside by the assertion that the discharge of urine only takes place *during* parturition, when fœtal respiration is interfered with, and not *before* it; that the instances of the imperforate urinary passages prove nothing, since in such instances the fœtus was diseased. Enough fœtuses are born, which show no sign of asphyxia, whose bladder is filled at the moment of birth, but whose liquor amnii still contains urea; and the fact that an otherwise well formed fœtus which is alive at the time of birth, has been shown to have considerably dilated bladder, ureters and renal pelves (*cf.* a case lately described by Runge, *Berlin Klin. Woch.*, 1879, p. 392), seems sufficient proof that urine is secreted at any rate during the second half of fœtal life, and is periodically evacuated.

(5) *Placenta.*

§ 93. The *placenta* (*cf.* § 85) forms a diskoidal cakelike spongy body, which in the case of a mature fœtus weighs ca. 500 grm. (1 lb.); the average weight of 1,492 placentæ at the tenth month, as shown by the statistics of the lying-in hospital here, amounting to 501·8 grm.; the placentæ of macerated fœtuses are heavier. The transverse diameter is 13·5—18·9 cm. (5·25—7·5 in.), the thickness 1·5—1·75 cm. (·6—·7 in.). The convex uterine is distinguishable from the concave fœtal surface, and the whole mass may be divided into a larger fœtal half—*placenta fœtalis*, consisting of the exuberant chorionic villi, and into a less bulky maternal half—*placenta materna*, consisting of the processes of decidua which form the fundamental frame-work of the organ. The fœtal surface is covered by the amnion, which can easily be stripped off as far as the point of insertion of the funis, and beneath it by the inseparably attached chorion; it is smooth and glistening. The substance occupying the interspace between the two membranes, has been spoken of in §§ 87 and 91. In the chorion run the umbilical vessels which are about to plunge into the placenta. The uterine surface is divided by superficial sulci into irregular islandlike lobes or *cotyledons*, and is lined by a greyish-white transparent membrane, which can only be removed in small pieces, and corresponds to the upper or cellular layer of the deciduæ serotina; it covers the cotyledons, bridges over the intervening sulci, and sends septa between them to the point of origin of the lobes, almost to the chorion. This arrangement however cannot be distinctly made out till the fourth month, and only then are the fœtal and maternal structures closely connected.

My own and Hecker's observations show that the placenta *grows* fairly regularly up to the 28th week, increasing by about 100 grm. (3·5 oz.) per month. From the 7th to the 8th month, I found an increase of about 60 (2 oz.), from the 8th to the 9th of about 40, from the 9th to the 10th of only about 6 grm. The placenta therefore does not grow as much during the last trimestrium as during the previous one, and by the end of the 36th k has pretty nearly reached its maximum development. rogressive changes then begin to take place in it.

wing to the somewhat flattened shape of the uterus at the e the placenta is formed, the latter is usually *inserted* on to anterior or posterior uterine wall, least often on the former.

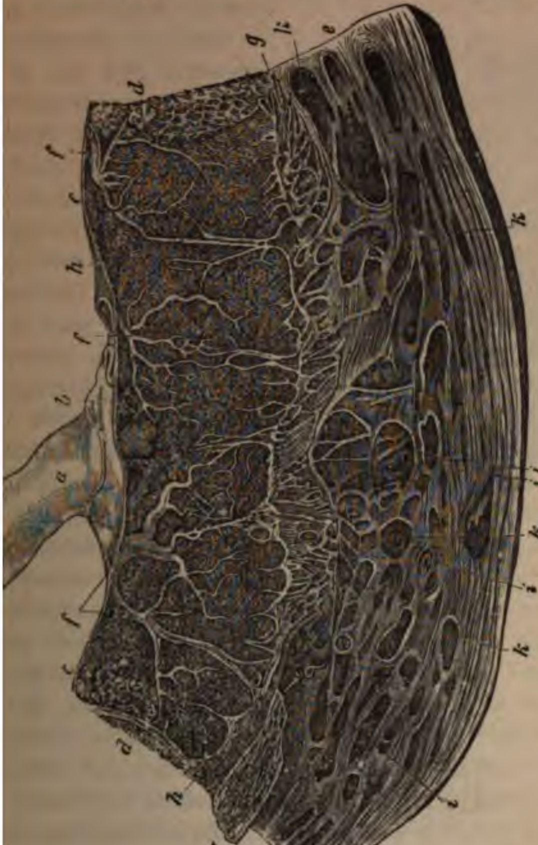

Fig. 81.—Section through the Placenta and Uterine Wall. (After Ecker.)

a. umbilical cord. *b.* layer of amnion. *c.* chorion. *d.* fœtal portion of the placenta. *e.* uterine wall. *f.* villous tuft. *g.* maternal portion of the placenta (decidua). *h.* continuations of the decidua penetrating into the placenta. *i.* spiral uterine arteries. *k.* dilated uterine veins (uterine sinuses).

en the placenta is mainly lateral, it lies more often on the t than on the left side; in very rare cases it is situated tly on the fundus. Occasionally one of its edges reaches internal os (low placental insertion); still less often, owing more marked form of this abnormality, the placenta is rted entirely in the lower division of the uterus and covers the internal os, extending more or less symmetrically on all sides of it (placenta prævia).

§ 94. The *structure* of the placenta is roughly as follows (figs. 31 and 32): when the maternal and fœtal elements become interwoven so as to form the placenta, the maternal give rise to the reticulum or frame-work, while the fœtal elements (consisting of a plexus of arborescent chorionic villi) penetrate into the former, and fill up the interspaces between the trabeculæ. The maternal part of the placenta is a cavernous structure, consisting of wide lacunæ which communicate with one another, and whose dissepiments, running at right angles to each other, constitute the placental "frame-work" seen in a transverse section. In a vertical section passing from the uterine to the fœtal surface, the following strata are (according to Winkler) met with:—

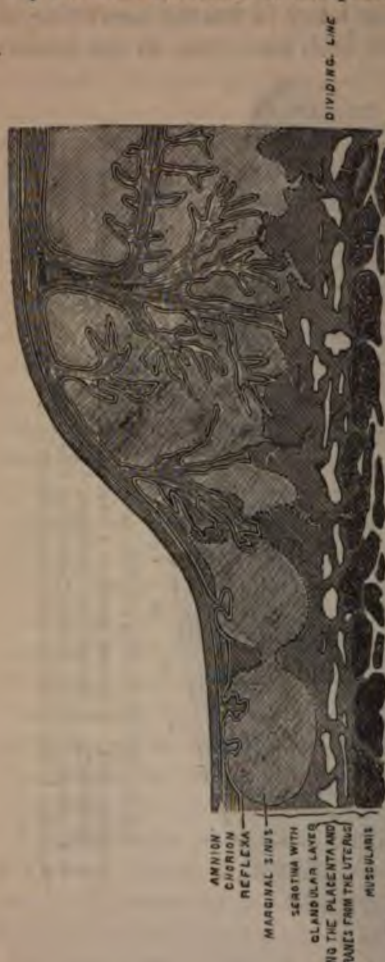
DIVIDING LINE
AMNION
CHORION
REFLEXA
MARGINAL SINUS
SEROTINA WITH GLANDULAR LAYER
LINE DIVIDING THE PLACENTA AND FŒTAL MEMBRANES FROM THE UTERUS
MUSCULARIS

Fig. 32.—Section through the Placenta and Uterine Wall, semi-diagrammatic. (After Leopold.)

1. Decidua serotina;
2. The intermediate, above-mentioned cavernous portion, entirely filled by the luxuriant fœtal villi;
3. The subchorionic limiting membrane, terminating the maternal tissue[1];

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[1] Kölliker and Leopold maintain that it forms a continuation of the serotina, only at the edge of the placenta as far as the lower surface of the chorion, but not as Winkler asserts, beneath the whole chorion.

4. The placental part of the chorion;
5. The gelatinous layer (or, it may be, the umbilical vesicle; *cf.* § 86);
6. The placental portion of the amnion.

The structure of the decidua has been described in § 89. The continuations of its cellular layer extend into the substance of the placenta, forming septa between the cotyledons and thus giving rise to the wide-meshed net-work already referred to, from whose vertical trabeculæ offshoots run in horizontal and oblique directions. The giant cells only extend for a short distance in these septa, the latter being mainly composed of a hyaline or finely striated substance with small cells in the centre; the interior of the lacunæ which are bounded by the trabeculæ, is lined by a delicate endothelial layer. The limiting membrane (3) has a similar structure to that found in the septa; it forms a moderately thick stratum which shuts off the superficial cavernous spaces (according to Kölliker and Leopold, only those which lie near the edge) on the fœtal side, and lies next to the chorion.

The placental villi (forming the fœtal portion of the placenta) arise from the uterine side of this limiting membrane (*Deckplatte*, Hyrtl) by means of trunks, which at first are thick, but in the majority of cases soon divide into branches, which again subdivide 3 or 4 times, and terminate in innumerable arborescent or tuftlike twigs. Each main trunk with its subdivisions forms a cotyledon, and has its own vascular loops, which send prolongations into the smallest terminal twigs. These villous tufts dip into the maternal blood spaces, and are the means by which the fœtus is nourished; other trunks, some large, some small, run in a straight or curved direction from the chorion to the decidua, and serve partly as blood channels, partly to attach the fœtal portion of the placenta more closely to the maternal.

§ 95. The fundamental structure of a placental villus is similar to that of the earlier chorionic villus (*cf.* § 90). As regards the epithelium there is difference of opinion. Some observers (Virchow, Kölliker, Langhans, Leopold) consider it to consist of a single layer and to be entirely of fœtal origin, while others (Goodsir, Schrœder v. d. Kolk, Jassinsky, Turner) believe it to be made up of a fœtal and a maternal layer. The settlement of this question depends on the way in which the fœtal and maternal portions are supposed to become connected during the development of the placenta. Some hold that the villi grow not only through the decidua, but through the maternal blood-vessels, so that after making their way through the wall of the vessel, the villus projects free into its lumen, only covered by its fœtal epithelium, and surrounded all round by the sharp edge of the perforated wall (Virchow, Kiwisch, Leopold); indeed it has been asserted that villi project into the lacunæ without even an epithelial covering, that owing to a reciprocal intergrowth of fœtal and uterine tissue, the epithelium of the villus atrophies, and the endothelial cells lining the lacunæ are forced apart (Winkler). Other observers (Sharpey, Reichert, Goodsir and those mentioned above) suppose that the villi become implanted in the tubular glands of the reflexa and in the interglandular tissue of the vera, and thus explain the fact that they receive an investment from the maternal tissues, consisting of flattened cells derived from the glands of the reflexa, and decidual cells from the vera. Further, the villus, by pushing the wall of the maternal blood-vessel before it at the place where it projects into the lacuna, receives another fine sheath, derived from the vessel and consisting of delicate endothelium with elongated nuclei. These divergent views seem to indicate that all the conditions mentioned may occur, though in part they are no doubt due to the fact that observations on the placentæ of lower animals have been at once accepted as true of the human placenta. The extent to which the layers referred to cover the villi, will of course simply depend on the degree of pressure under which the connection of the villi with the maternal structures is effected.

The lining of the villus which is of fœtal origin, consists of small, regular, indistinctly granular flattened cells; that of maternal origin, when present, consists of much larger rounded [sometimes crenulated] uni-nucleated, generally non-granular cells. When a villus projects freely into the lumen of a vessel, it may often be observed that the delicate sheath derived from the vessel passes from the summit of one on to a neighbouring villus, without lining the whole of the first.

Into the little villous twig projecting into the lacuna, enters a terminal branch of the umbilical artery, which takes a nearly straight direction (though it is twisted spirally on itself), and forms a loop before passing into the efferent vessel. Everywhere in the villi, even in the stems, occur numerous anastomoses and capillary plexuses; during the earlier months moreover, fine *superficial* capillary net-works have been shown to lie beneath the epithelium and to surround the whole villus; they communicate with the capillaries which are placed further from the surface.

The stems of those villi which ascend from the limiting maternal membrane to the serotina and serve to connect the fœtal closely with the maternal portion (*cf. supra*), are as a rule thicker, and often terminate in the decidua by means of bulbous extremities, and having lost their fœtal epithelium; they also have blood-vessels, although these usually do not reach the summit of the villi. Such non-vascular and atrophied villi are particularly common at the edge of the placenta.

The growth and multiplication of the villi occur through proliferation of the cells of the connective tissue layer which lie at their free end, through an increase of the epithelium and a formation of epithelial processes. These consist of a hyaline or finely granular substance with a central nucleus, into which very soon a vascular loop and some of the mucous tissue which supports it, grow out from the villus, and pushing the nuclei to the periphery form a new villus. Another way in which epithelial processes may be formed, consists in the several portions of the fœtal placenta becoming connected with one another by means of broad round trabeculæ (Langhans).

The structure of the chorion and amnion is the same as that of the peripheral portions of these membranes. The superficial membrane of the fœtal part of the placenta (derived from the chorion) and its vasa propria have already been spoken of in § 92.

§ 96. The fœtal and maternal vascular channels are so interwoven in the placenta that the two streams of blood everywhere flow close to each other, separated only by thin highly permeable walls. An interchange between them is therefore made very easy, though we have as yet but little satisfactory information as to what processes actually take place. It is certain however that an exchange both of solids in solution and of gaseous substances occurs, and it is highly probable, though not absolutely proved, that solid particles pass from the mother into the fœtus.

The *placental circulation* may be described in the following manner. The umbilical arteries pass to the placenta at an acute angle, and as a rule immediately anastomose; they then suddenly dilate to form what Hyrtl has called the "placental bulbs," and without reaching the edge of the placenta, become curled, and dip into the placental tissues in order to break up into the vessels of the villi. Beneath the amnion the arteries are lined by a hyaline or faintly striated firm membrane (the limiting maternal layer, Hyrtl's "Decklamella"). The branches of the umbilical vessels take a very spiral course as they bore their way into the cotyledons; each of the latter is supplied by one, and only when very large by several arteries; in the latter case the arteries never anastomose, but each has its own area of distribution. The veins on the contrary form a wide-meshed net-work round the arteries.

The maternal vessels, *i.e.* the utero-placental arteries and veins, enter and leave the placenta on its convex aspect. The arteries, mainly branches of the internal spermatics, perforate the uterine wall in large corkscrewlike spirals, and make their way as numerous, but in size constantly diminishing branches to its inner surface, where they, in some cases becoming capillary, either open into the enormously dilated veins (uterine sinuses), or perforate the decidua and enter the placenta itself. The entrance takes place (by means of openings which can be seen in the decidua at the points where the septa between the cotyledons intersect) either directly into the placental lacunæ, or by means of a kind of vascular tube 3—4 mm. (·2 in.) long, composed of maternal placental tissue like the other vascular spaces, and lined merely by endothelium. The placental blood channels therefore are practically nothing more than cavernous dilatations of the capillaries belonging to the decidua, which have become enormously widened, lost their walls in consequence, and have become converted into the irregular maternal lacunæ into which the villi project. From these cavities or sinuses the blood passes back into the uterine venous plexuses, both through the almost wallless veins of the serotina which lead into the deeper uterine veins, and (this is the main channel) through the great *marginal sinus*, the *vena coronaria placentæ*. The latter is a wide (in some places wider than a goose-quill) tube, lined with epithelium, which either continuously or with local interruptions encircles the placenta; it is very rarely entirely absent and possesses numerous slitlike apertures both towards the placenta and towards the uterus. By means of these apertures the blood passes either directly or through short canals out of the great cavities of the placenta back into the coronary vein, and from it to the veins (sinuses) of the deeper layer of the decidua vera or of the uterine tissues. The structure of the veins and sinuses of the latter has been already described in § 64.

Since the various maternal lacunæ communicate freely with one another, the movement of blood must be very irregular; on the other hand the possibility of the blood escaping in any direction (which is permitted by this arrangement) acts to some extent as a safeguard against stagnation in the vascular channels of the placenta, or indeed against the rupture of the walls which might otherwise easily take place, owing to the frequent alteration of the blood-pressure in the uterine vessels. The turgescent condition of the chorionic villi which is probably maintained for considerable periods, and the pressure which the liquor amnii exerts on the inner layer of the placenta, doubtless also lead to the slitlike spaces between the villi and the lacunæ maintaining their shape.

§ 97. Amongst the numerous abnormalities in the shape of the placenta, as described by Hyrtl, most practical importance attaches to the not uncommon formation of one or more *accessory placentæ, placentæ succenturiatæ.* They do not arise through constriction of one of the lobes of the main organ, but through a heaping up of the villi (which are originally spread over the whole chorion) into two or more collections of different sizes, of which the smaller forms the placenta succenturiata. The latter is connected with the main placental mass by a bridge of parenchyma or, what is less common, only by vessels; when the two placental masses are close together, the bridge of parenchyma is never absent, and *vice versa.* In certain rare cases the accessory mass is semilunar, its concave edge being turned towards the main placenta; when both horns of the crescent have become united to the convex edge of the latter, there remains between the two a bare thin *island* of *chorionic tissue* which is free from villi, and forms a windowlike aperture in the placenta—*placenta fenestrata.* In this island may lie small *placentulæ succenturiatæ*, and thus the number of apertures be increased, while their size decreases. Sometimes wide branches of the umbilical vessels run through the apertures. At the time of labour, entire accessory placentæ, *i.e.* the separate cotyledons lying in the interval, may remain behind unnoticed, and lead to serious mischief.

(6) *Umbilical Cord.*

§ 98. The mother is connected with the fœtus by means of the *umbilical cord*, funiculus umbilicalis, which arises at the umbilicus of the child, and is inserted into the fœtal surface of the placenta. In a young embryo there pass out of the umbilical opening (*cf.* § 86) the vitello-intestinal duct with the umbilical vesicle and its vessels, the pedicle of the allantois in process of becoming obliterated, with its vessels and a loop of intestine, all of them lined by that portion of the amnion which extends between the umbilical orifice and the part of the chorion lying opposite to it. Those structures at an early date almost entirely disappear[1], the loop of intestine is retracted into the closing abdominal cavity, and from the 3rd month onwards the cord consists merely of a covering derived from the amnion (*umbilical sheath*), of the *umbilical vessels*, and the soft connective tissue (*Wharton's jelly*) in which they are imbedded. At first it is short, but soon it grows rapidly and reaches an average length of 50—55 cm. (19·5—21·5 in.).

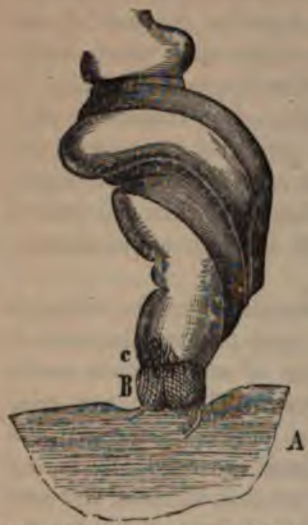

Fig. 33.—Wreath of capillaries at the margin of the skin and umbilical cord. (After Virchow.)
A. abdominal wall. B. persistent portion of the umbilical cord. c. margin of capillary wreath.

The amniotic *sheath* cannot be stripped off from the jelly of Wharton; it ends, especially in well developed fœtuses, at a distance of ·5—1·25 cm. (·2—·5 in.), or even further from the abdomen, the skin of which is continued for that distance on to the cord (cutaneous or fleshy navel). Conversely, the amnion sometimes does not end at the abdominal wall, but expands like a flattened funnel in the immediate neighbourhood of the navel

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[1] For further information as regards the persistent condition of the vitelline duct, *cf. supra* (§ 86, note).

(amniotic navel); at its opposite extremity it is continuous with the layer covering the placenta. The amniotic sheath of the cord has a stratified epithelium, but is non-vascular; at a distance of 9—12 mm. (·4—·5 in.) beyond the umbilical ring is situated a wreath of capillaries derived from the skin of the abdomen (fig. 33), whose upper border forms the line of demarcation, when later on the cord falls off. Between the epithelial cells are stomata (Köster), which may possibly be connected with the serous channels in Wharton's jelly.

The *jelly of Wharton* (corresponding to the subcutaneous connective tissue of the abdominal wall, and in part derived from the allantois) consists of a gelatinous matrix, in which run strands of fibrillæ, interlacing with each other in such manner that rounded or oval interspaces remain free from fibrillæ. The firmer portions form a thin superficial layer beneath the amnion, a sheath round every vessel and a sort of axial cord which sends processes towards the surface between the vessels. Within the three islandlike masses between the fibrillæ, lies a net-work of mainly stellate cells, which form an anastomosing system of serous channels which can be injected, and in which contractile cells are found. True lymphatics are absent; so also are nerves, except in the portion nearest to the fœtus.

The two *umbilical arteries*[1] at a very early period are the direct continuations of the bifurcating aorta, but later on become continuations of the hypogastric arteries; they are smaller than the vein, and pass, crossing each other as they do so, through the umbilical ring into the cord, in which they run to the placenta without giving off any branches; between them lies the single *vein*. The course of these vessels is only straight in very short and thin cords; as a rule it is that of a left-handed spiral (looking from the navel towards the placenta); hence arises the twisted appearance of the cord. These *spiral twists*[2] are most probably due to the higher tension of the wider vein brought about by a greater blood-pressure, which tension stretches the vein more than the arteries, obliges it to take a curved course and compels the arteries to follow it (Neugebauer); inasmuch however as the right artery is usually rather larger than the left, the twist generally takes place towards the left side. It is also possible that the rotation is simply a consequence of the rebound which is brought to bear on the embryo by the stronger blood-flow through the right artery, and which is transmitted to its pelvis. In rare cases the blood-vessels take an *alternating* course, a left-handed spiral changing to a right-handed, and *vice versa;* still more rarely their course is *erratic*, the vessels taking an equal share in forming a great glomerulus. These vessels not only have a spiral course round one another, but each of them is also *rotated on its own axis.* At those points where the vein shows grooves and indentations on its outer surface, as a result of that rotation, it has in its interior semilunar or ring-shaped *valves:* the arteries only possess traces of these.

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[1] In some cases only one functional artery is present.

[2] Kehrer (*l.c.*) gives the name of "*spirals*" to twists that cannot be undone, that are made permanent by their investment of amnion; those on the contrary that disappear when the cord is untwisted, he calls "*torsions*." The latter are mainly due to changes in the fœtal position, and he believes that rotations of the fœtus may first of all produce "torsions," and that when these have become persistent by the growth of the amniotic sheath, they become "spirals."

The coats of both arteries and veins are very thick, especially (both in their intra-abdominal and free portions) as they approach the umbilicus; they are moreover very rich in smooth muscular fibres; hence their great contractility and liability to extreme narrowing. There is no elastic intima between the muscular fibres and the endothelium; only in the abdominal portion does it appear as a distinct layer, and gradually increase in a central (as opposed to a peripheral) direction. The difference in thickness between the walls of the arteries and veins is not so marked as in the rest of the body, though the vein has somewhat thinner walls than the artery. Vasa vasorum are absent.

§ 99. The average *length* of the cord, as given above, is subject to considerable variations. It may fall to 15 (6 in.) and even 7 cm. (cases of absence of the cord, in which the fœtus is immediately adherent to the placenta by means of its umbilicus, belong to monstrosities). It is more often longer (Neugebauer and Schneider), amounting to 160 (63 in.), 183 (72 in.) and even 194 cm. (76 in.); great length predisposes to the cord being coiled round the body, neck and limbs of the fœtus, as is so commonly seen (1 : 4·5 of all births). The *thickness* of the cord varies with the quantity of Wharton's jelly; hence the difference between a thin and a fat cord.

The so-called *spurious knots* are local collections of Wharton' jelly, or circumscribed collections of simple and twisted vascul

s; they have no importance. *True knots*, simple or double,
o-called weaver's knots, are rare. They are produced, when
cord is long, by the fœtus during its movements slipping
ugh a loop and drawing it tight; this may happen during
nancy, although it occurs more frequently during labour.
the first case the knot is drawn tighter, and is therefore
ller than in the latter; moreover it shows a diminution of
jelly at its concave borders.

he cord is generally inserted obliquely into the placenta, and
ly exactly at its middle (insertio centralis); as a rule it is
ed at one side (insertio lateralis), and nearer to one edge.
etimes the seat of insertion is displaced to the edge (ins
ginalis), or beyond it, to the part of the chorion which is free
villi, in which case the vessels divide between the chorion and
amnion before they reach the placenta (ins. velamentosa).
in exceptional cases does the cord divide before its insertion
two or more branches, which pass separately to the placenta
furcata).

c. *The Fœtus.*

(1) *In the different months of Pregnancy.*

100. An acquaintance with the changes in form, size and
ht, which take place in the ovum and in the fœtus, as preg-
y advances, is of importance for the accoucheur. Several
of the 1st *month* are in existence, and some have been very
rately described by Thomson of Edinburgh. Figs. 34 and
copied from Kölliker) show such in their natural size; the
nated age of the first is 12—13 days, while the second
ngs to the end of the 3rd, or the beginning of the 4th week.
ell preserved exactly four weeks (28—30 days) old ovum has
described by Waldeyer. Together with the membranes, it
about the size of a pigeon's egg (fig. 36), is 19 mm. (·75 in.)
, 16·5 mm. (·6 in.) wide, and weighs 2·3 grm. (35·5 grs.);
length of the embryo (fig. 37), measured from the summit
e posterior cephalic curve in a straight line to the caudal
e opposite the insertion of the hind limbs, amounts to 8 mm.
in.), while the actual length of the dorsal line, from the
mit of the anterior cephalic curve to the apex of the coccyx,
unts to 20 mm. (·75 in.). The embryo, both in form and in

the disposition of its organs, resembles other mammalian embryos, the head and trunk forming one mass, from which the

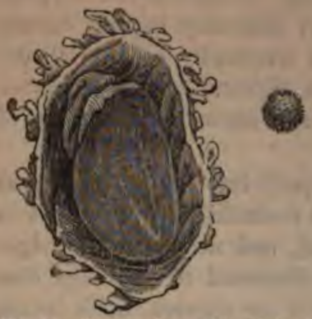

Fig. 34.—Human Ovum 12—13 days old. (After Thomson.)

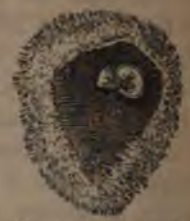

Fig. 35.—Human Ovum at the end of the 3rd or the beginning of the 4th week. (After Thomson.)

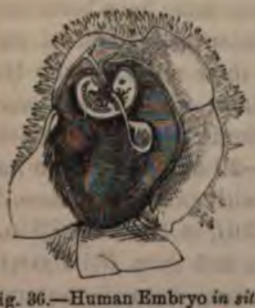

Fig. 36.—Human Embryo *in situ* within its membranes, 4 weeks old, natural size. (Waldeyer.)

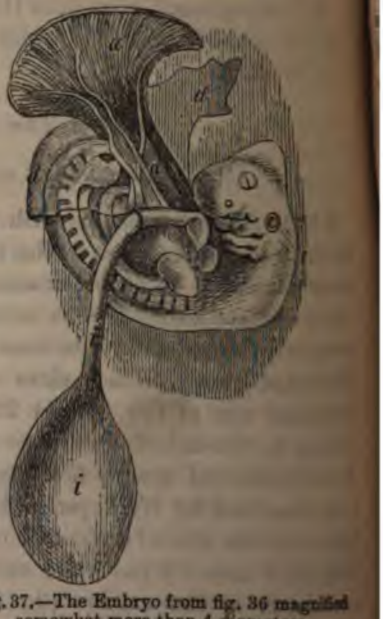

Fig. 37.—The Embryo from fig. 36 magnified somewhat more than 4 diameters.

a, rudiment of the umbilical cord. *d*, caudal fold of the amnion. *i i*, yolk-sac with yolk-duct.

narrower caudal extremity projects; visceral arches distinct; limbs scarcely indicated; umbilical cord very short and wide, ith its arteries and single vein ; yolk-sac and yolk-duct still rge. The amnion lies moderately close to the embryo, and separated from the villous chorion by a clear cavity.

An embryo dating from the *2nd month*, 6—7 weeks old, is ry beautifully figured by Waldeyer. It measures (fig. 38), om the summit of the posterior cephalic curve to the caudal rve, 13 mm. (·5 in.) in a straight line, the real length of the rsal line, from the summit of the anterior cephalic curve, being ·5 mm. (1 in.). An ovum of 8 weeks, which is figured in cker's *Icon. Physiol.* (Plate 27, fig. 7), has a length of 3·6 cm. ·5 in.), the embryo measuring 2·1 cm. (·8 in.). By this me the amniotic cavity has increased, the fluid contained in is more abundant, the amnion is in contact with the chorion, d the villi of the latter are es- ecially well developed at one spot. he umbilical vesicle is very small, s pedicle is filiform ; the umbi- cal vessels, passing to the chorion, e the only remains of the allan- is that are still visible, and they rm the main constituent of the nbilical cord. The latter has creased in length ; the umbilical g is narrower, although still ntaining coils of intestine. The head is more distinctly con- icted off from the trunk, and the eyes can be made out as tle dots ; the mouth and nose can also be distinguished, and the lower jaw and clavicle, the first centres of ossification pear ; the several segments of the limbs are differentiated. e primitive kidneys have almost disappeared, and have divided o urinary and generative organs.

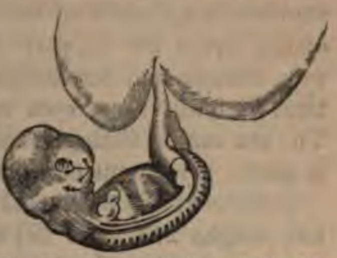

Fig. 38.—Human Embryo of the 6th —7th week magnified 2 diameters. (After Waldeyer.)

§ 101. Towards the end of the *3rd month*, the ovum is —11 cm. (3·75—4·25 in.) long. The chorion has lost a ge part of its villi, and the placenta, though still very small, perfectly distinct. The umbilical cord is much longer, and sted, and is inserted far down into the lower end of the nk ; the intestine is retracted from the umbilical opening. e embryo is 7—9 cm. (2·75—3·5 in.) long, and weighs ut 30 grm. (460 grs.). The neck now separates the head m the trunk, the latter, owing to the development of the ribs, being distinctly divisible into chest and abdomen. The oral and nasal cavities are separated by the palate, the former being closed by the lips. Teeth begin to form in the jaws; in most of the bones, centres of ossification have appeared; in the extremities, fingers and toes can be made out, as well as the rudiments of the nails. The scrotum and the labia pudendi originate as cutaneous folds; the penis and clitoris are still of equal length.

By the end of the *4th month*, the *placenta* has increased in thickness and size. The umbilical cord is more twisted and, owing to the formation of Wharton's jelly within its sheath, has become thicker. The *fœtus* is 10—17 cm. (4—6·75 in.) long, and weighs on an average 55 grm. (850 grs.)[1]; its head amounts to a quarter of the whole length of the body, and the cranial bones are in part ossified, although they show very wide sutures and fontanelles. The face becomes more distinct; mouth, nose, eyes and ears attain their proper shape. The sex can be distinguished; the skin is firmer; hairs begin to form. The fœtus occasionally moves its limbs a little.

A fœtus at the *5th month*, is 18—27 cm. (7—10·5 in.) long, and weighs 273 grm. (8½ oz.); the liquor amnii however still weighs more than the fœtus. The head continues relatively very large. The face has a senile look; the eyelids begin to open. Distinct downy hairs (*lanugo*) show themselves, beginning along the lines of the eyebrows and on the forehead. The skin is richer in fat and therefore tenser, its surface being covered by *vernix caseosa* (a white greasy substance consisting of epidermic scales, downy hairs and sebaceous matter derived from the skin), though this is still in small quantity. "Fœtal movements" are perceived by the mother.

§ 102. By the end of the *6th month*, the length of the fœtus amounts to 28—34 cm. (11—13·5 in.), the weight to 676 grm. (23¾ oz. avoir.). The head continues disproportionately large. The upper portion of the chest appears prominent, in consequence of the large size of the pectorals; the gluteal muscles are better developed, and the whole body looks plumper than during the previous month. The umbilical cord is no longer inserted so low down, but in the middle third between the pubic symphysis and the xiphoid appendix. The eyelids are open, eyelashes and eyebrows more distinct; the hairs of the scalp grow longer and gradually lose the characters of lanugo. The testes approach the inguinal rings. The small intestine has bile-stained contents; so also may have the commencement of the large intestine; indeed the contents of the latter may be the darkest (*meconium*). A fœtus born at this period moves, and makes feeble attempts at inspiration, but they soon cease.

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[1] The measurements and average weights are borrowed from Hecker's data.

At the *7th month*, the fœtus reaches a length of 35—38 cm. (13·75—15 in.), and an average weight of 1,170 grm. (41¼ oz.). The head, still very large, is firmer, the extremities plumper, although the skin continues much wrinkled. A testicle may often be found lying close to the external inguinal ring. At the beginning of the 7th month, the whole body is covered with hairs, especially the forehead, cheeks, the neighbourhood of the mouth, and the neck; on the trunk the hair is thick, but shorter; it is least abundant on the limbs, from the ends of which it is partly absent. The larger part of the great intestine contains meconium. The pupillary membrane has generally disappeared by this time, probably always by the end of the month. The fœtuses which are born alive between the 24th and 28th week, generally perish very quickly, exceptions being extremely rare, and only to be credited with the greatest circumspection[1].

In the *8th month*, the length amounts to 39—41 cm. (15·25—16 in.), the weight to 1,571 grm. (3½ lb.). The umbilical cord is inserted 1·5—3 cm. (·6—1·2 in.) below the point midway between xiphoid appendix and symphysis. The hairs of the scalp are more abundant, the down on the face is disappearing; the nails have become harder, although they do not yet reach the finger tips. One of the testicles has generally descended into the scrotum. At the end of the 8th month, ossification begins in the lower epiphysis of the femur. With some care a fœtus born about this period can be kept alive.

In the *9th month*, the length reaches 42—44 cm. (16·5—17·25 in.), the weight 1,942 grm. (4¼ lb.). The shape of the body becomes more rounded, owing to a greater development of fat; the face larger and pleasanter; the miliaria which were plentiful round the mouth and on the cheeks[2], are in process of disappearing. The cranial bones are still flexible, and the nails not fully developed. The hair of the scalp is more abundant, but the lanugo elsewhere becomes less and less distinct. The vitality of children born at this period, approaches that of mature fœtuses, although they still have much less energy than the latter; they sleep a great deal, and unless well cared for, usually perish.

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[1] Instances are given by Cullingworth in the *Obst. J. Great Britain*, June, 1878, p. 163. *Cf.* also the remarks by Underhill in the *Amer. J. Obstetrics*, xii., 1879, p. 96.

[2] *Cf.* Küstner, *Arch. f. Gyn.*, xii., p. 102; and Epstein, *Centralzeitung f. Kinderheilk.*, ii., No. 4.

In the first weeks of the 10*th month*, the fœtus measures 45—47 cm. (17·75—18·5 in.), and weighs 2,323 grm. (5 lb.). By degrees it assumes all the characters of a mature fœtus, and indeed possesses them during the last two weeks.

The measurements and weights given above are, as already observed, borrowed from Hecker's data. For the 7th, 8th and 9th months, the measurements made in this maternity (*cf.* Fesser) gave similar figures, while on the other hand those obtained by Ahlfeld are much larger. I will place the results for the months referred to side by side, to allow them to be compared :—

	HECKER.	SPIEGELBERG.	AHLFELD.
7th month	35—38 cm., 1170 grm.	34·8 cm., 1069 grm.	38·3 cm., 1388 grm.
8th ,,	39—41 cm., 1571 grm.	38·8 cm., 1511 grm.	42·2 cm., 1880 grm.
9th ,,	42—44 cm., 1942 grm.	45·7 cm., 2189 grm.	46·9 cm., 2517 grm.
10th ,,	45—47 cm., 2323 grm.	Not specially recorded, because very similar to length and weight of the mature fœtus.	49·8 cm., 3096 grm.

Toldt's observations, made on 200 fœtuses, show that the general development as well as that of special parts must be taken into account, in estimating the age of a fœtus. In the first place, the *weight*, because influenced to a great extent by the state of nutrition, is of less value than the *length*. The latter at the commencement of the 5th week (measured from the vertex of the head along the middle line of the back to the apex of the coccyx) amounts to 1·5 cm. (·6 in.), and increases during each of the following weeks by about ·5 cm. (·2 in.), so that at the end of the 8th week it reaches 3·5 cm. (1·3 in.). At the end of the 3rd month, the body-length (from the vertex of the head to the heel, when the body is extended) is 7 (2·75 in.), at the end of the 4th month 12 (4·75 in.), of the 5th 20 (7·75 in.), of the 6th 30 (11·75 in.), of the 7th 35 (13·75 in.), of the 8th 40 (15·75 in.), of the 9th 45 (17·75 in.), of the 10th 50 cm. (19·5 in.); it therefore increases after the 6th month, at the rate of 5 cm. (2 in.) a month.

The individual parts of the body which yield reliable data by which to estimate the age, are the *degree of development of the hairs*, the *presence and size of certain centres of ossification*, and the *degree of development of some parts of the brain*. In the *os calcis* at the beginning of the 7th month, there appears a centre of ossification measuring 3 mm. (·1 in.) in diameter, which increases in length, and by the end of the 8th month amounts to 4—7 (ca. ·2 in.), of the 9th 6—10 (ca. ·3 in.), of the 10th 9—12 mm. (·35—·45 in.). In the *astragalus*, ossification sets in at the beginning of the 8th month; the nucleus has an ellipsoidal shape, and by the end of the month measures 2—3 (·1 in.), at the end of the 9th month 5—6 (·2 in.), of the 10th 7—9 mm. (·3 in.). In the lower *femoral epiphysis*, the centre of ossification is usually only formed in the 9th month. Centres of ossification appear in the upper epiphysis of the *tibia*, and in rare cases in the upper epiphysis of the *humerus* towards the end of the 10th month; if they are present, the maturity of the fœtus may safely be inferred, although their absence without further evidence is not proof of immaturity. Lastly, the *superficial configuration of the brain* serves to indicate the age; the shape of the *Sylvian fossa* does so especially, since the several stages of its development are connected with definite periods of time. In the 7th month, it forms a wide more or less three-sided groove, which narrows and deepens in the 8th month, while in the 9th, the parts adjacent to it (frontal and temporal lobes) gradually approach each other, till by the end of the month the *fissure* is completely formed. Again, during the 9th month, only the principal sulci and convolutions are present; at the end of the 9th and the beginning of the 10th month, numerous *branch* or *secondary sulci* appear, and the whole brain is much more highly convoluted.

(2) *The mature Fœtus.*

§ 103. A mature fœtus, according to our own measurements (*cf.* Fesser), is on an average 51 cm. (20 in.) long, and weighs 3,128 grm. (nearly 7 lb.)[1]; its width across the shoulders (the binacromial diameter) amounts to about 12 cm. (4·75 in.), and corresponds to a circumference at the shoulders of about 34 cm. (13·25 in.). The dorso-sternal diameter is 9—9·5 cm. (3·5 in.), the width at the hips (or biniliac diameter) 9·5—10 cm. (4 in.). Every part of the body is well rounded off, and furnished with a thick layer of fat; the skin has lost its deep rosy tint, and the vernix is abundant only on the back of the child and on the flexor aspect of its limbs; the lanugo has almost disappeared; the hairs of the scalp are mostly dark and about 3 cm. (ca. 1 in.) long, the nails project clawlike beyond the tips of the fingers, and reach the tips of the toes. The head is still the most voluminous part of the organism; especially is the cranium large in proportion to the face. The latter now shows a fresh plump appearance, and miliaria are confined to the point of the nose; the bones of the head are hard, and their edges lie close together; the sutures are narrow. The cartilages of the ears and nose feel hard; eyebrows and eyelashes are well developed. The thorax presents a distinct convexity; the breasts in both sexes are well formed, and contain some secretion. The umbilical cord is inserted immediately below the middle of the longitudinal axis of the body (indeed after the 6th—7th month, the relative position of its insertion remains unchanged; its distance from the symphysis compared to that from the ensiform process, being according to Hecker as 1 : 1·6). The scrotum is much corrugated and brownish; the testes can be felt in it, but the tunica vaginalis is still open. In girls the labia majora are in contact, although they do not always completely conceal the minora. The *meconium*[1], a greasy substance consisting of intestinal mucus (inspissated) and epithelium, of small particles (derived from the liquor amnii, *e.g.* epidermic scales, lanugo and vernix caseosa) that have been swallowed, and deeply bile-stained (crystals of cholesterin and bilirubin), now only fills the large intestine. The centre of ossification in the lower femoral epiphysis, usually measures about ·5 cm. (·2 in.) in diameter, but may be much smaller or absent.

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[1] Hecker gives the length as 51·2 cm., and the weight as 3,275 grm.

Mature children look about them in a lively manner, move their limbs vigorously and cry lustily. Soon after birth they evacuate urine and meconium; they make suction movements, and the nipple, if proffered to them, is greedily seized and firmly held.

§ 104. The length and weight are subject to frequent deviations, both above and below the average which we have given. The heaviest fœtus which I have hitherto met with in the hospital here, weighed 5,200 grm. (11½ lb.), the longest measured 58 cm. (22·85 in.); but in private practice I have delivered a fœtus of 6,000 grm. (13 lb.), with a length of 57 cm. (22·5 in.)[2]. Generally speaking, length increases with weight, although not

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[1] *Cf.* Zweifel, *Arch. f. Gyn.*, vii., p. 474.

[2] We have numerous accounts of very large and heavy fœtuses, of so-called *giant children*. Amongst well authenticated recent cases, *i.e.* where the fœtus was measured by a reliable physician, I may refer to that of Wolff in Eutin (*Berliner Klin. Wochenschrift*, 1878, p. 620): boy weighing 8,250 grm. (18 lb.); 62·5 cm. (24·5 in.) in length; the circumference of his head was 41·5 cm. (16·25 in.); to that of Mayer in Reinbach (*ibid.*, p. 648): boy of over 7,500 grm. (16½ lb.). The published cases of Hunter-Mair and Bradley in *British Med. J.*, Jan. 4, 1879, of White in *New York Med. Record*, March 23, 1878 (where one fœtus is said to have weighed 20 lb. after loss of its brain), are not of much value, inasmuch as the weight is given in pounds, without its being stated whether Apothecaries or other weights are referred to. The fœtus of 6,000 grm. (13¼ lb.) weight observed by myself and Dr. Langer, was expelled in the third cranial position; and the extraction of the head, and still more that of the shoulders, caused enormous difficulty. The measurements were: length 57 cm. (22·5 in.), circumference of head 37 (14·5 in.), of shoulders 45 (17·75 in.), binacromial diameter 16 (6·25 in.), circumference at hips 39 cm. (15·25 in.); the direct, diagonal, biparietal, and bitemporal diameters were 12, 14·5, 10, 9·5 cm. (ca. 4·75, 5·75, 4, 3·75 in.).

same proportion; the children just referred to as weigh-
5,200 and 6,000 grm. measured only 56 and 57 cm.
ctively, while the fœtus which measured 58 cm. only
ed 4,470 grm. (9¾ lb.); length therefore varies less than
t.

e circumstances which influence the size of the fœtus, are
and chiefly the sex, boys being on an average longer and
er than girls; 51·5 cm. (20·25 in.) and 3,201 grm. (7 lb.)
former correspond to 50·5 cm. (19·75 in.) and 3,056 grm.
b.) of the latter. Secondly, the number of the pregnancy,
ren of primiparæ weighing on an average 120 grm. (4¼ oz.
.) less than those of multiparæ; the length does not show
important difference. Thirdly, the age of the mother; up
e 39th year as a rule the weight gradually increases, after
decreases, and the best developed fœtuses are born when a
in pregnancy coincides with a certain time of life ("pre-
tion years"—Wernich). Fourthly, the constitution and
ical development of the parents; it is easy to see that the
of nutrition of the maternal organism must have an impor-
influence on the formation of the fœtus, and Fasbender's
erous measurements show that the tallest women bear both
heaviest and the longest children. In girls as a rule the
is larger in comparison with the head, and inasmuch as
length of their body is below that of boys, this greater
lopment must affect the transverse diameters; it depends
more abundant supply of the panniculus adiposus. More-
the contrast between the male and female figures, so familiar
dults, is already indicated at birth. As regards numbers,
girls are on an average born to 106 boys (according to Veit,
igures in Prussia are 100 to 105·88).

105. The *head* is of most importance during parturition, on
nt of its size and unyielding character, and therefore claims
al attention. It is of ovoid form, the smallest end pointing
wards, the largest forwards (fig. 39), and is divided into
um and face, these consisting of the same bones as in the

ie flat cranial bones are still incompletely ossified and thin,
osed mainly of diploë, and therefore flexible and elastic; at
ame time they are to some extent displaceable in relation to
another, since they are still ununited, but merely connected

by fibrous material, a continuation of periosteum and dura mater; in this way are formed the *sutures*. Some of these sutures have the same names as those of an adult, but in addition to the latter, the prolongation of the sagittal suture between the two frontal bones (which is generally absent in adults) called the frontal suture, must be especially noticed; sometimes also the sagittal suture is continued over the posterior part of the cranium. At the point where the rounded off angles of the frontal, sagittal and coronal sutures meet, is situated a large membranous gap—the *anterior* or *great fontanelle* (fig. 40). Its shape is quadrangular, similar to that of a kite, the short posterior sides being formed by the parietal bones, the longer anterior sides by the frontals; its anterior angle is much more

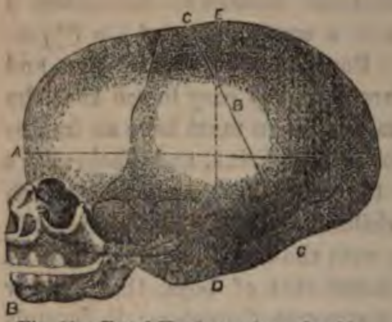

Fig. 39.—Fœtal Head seen from the side.

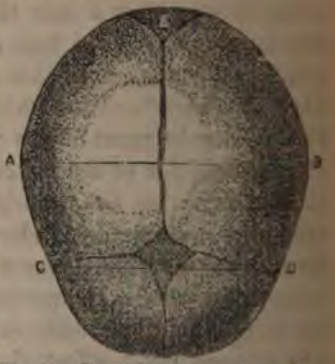

Fig. 40.—Fœtal Head seen from above.

pointed and longer than the posterior. The *posterior* or *small fontanelle* lies at the point where the posterior end of the sagittal meets the lambdoidal suture; only when ossification has been somewhat retarded, is a considerable membranous gap formed; as a rule this gap has the shape of a triangle, the base being formed by the rounded top of the occipital bone, and its elongated sides by the rounded posterior superior angles of the parietal bones. In the rare cases in which the sagittal suture is prolonged on the upper portion of the posterior part of the skull, the small fontanelle will of course have a quadrangular shape. At the point where the lower angles of the parietals meet the squamous suture, there are also situated somewhat broad interspaces, called the *lateral fontanelles* (fonticuli Casserii), of which the anterior being covered by soft parts cannot be felt; the posterior however may be, and owing to its triangular shape, is apt to be confused with the occipital fontanelle.

In some cases of delayed ossification, so-called *anomalous* fontanelles are found in other parts of the skull. A very small *naso-frontal* one occurs, bounded by the inner and lower angles of the frontal and of the nasal bones; a triangular *cerebellar fontanelle* just above the posterior edge of the foramen magnum in the median line of the occiput; a quadrangular *meso-frontal* in the lower portion of the frontal suture; a *sagittal* fontanelle in the middle or posterior portion of the sagittal suture, sometimes formed only by one parietal bone, sometimes more or less symmetrically by both. *Anomalous sutures* are rarer (*cf.* Gruber, Virchow's *Arch.*, vol. 50).

§ 106. The size of the fœtal head, like that of the pelvis, is estimated by measurements taken in different directions. The diameters, which are important for practical purposes, and especially for understanding the mechanism of labour, are the following:—

1. *Sagittal* diameters (fig. 39): *a.* The *direct* or fronto-occipital (F.O.) from the glabella to the most prominent point of the occiput (*a*, *a*)=11·75 cm. (4·5 in.), according to my own measurements; to this corresponds a periphery of about 33—34 cm. (13—13·5 in.). *b.* The *great diagonal* or mento-occipital (M.O.) from the point of the chin to the same part of the occiput (*a*, *b*)=13·5 cm. (5·25 in.), with a periphery of 36 cm. (14·25 in.). *c.* The *small diagonal* or suboccipito-bregmatic, from a point about midway between the occipital tubercles and the foramen magnum, to the posterior edge of the great fontanelle (*c*, *c*)=9·5 cm. (3·75 in)., the corresponding periphery being 28—29 cm. (11—11·5 in.).

2. *Transverse* diameters (fig. 40): *a.* The *great* transverse d. (*a*, *b*), connecting the two parietal eminences, called therefore *bi-parietal* (B.P.)=9·25 cm. (3·75 in.); *b.* the *small* or *bitemporal* d. (B.T.) the greatest distance between the two sides of the coronal suture (*c*, *d*)=8 cm. (3 in.).

3. *Vertical* diameters: *a.* From the vertex to the base of the cranium, *i.e.* to the anterior edge of the foramen magnum (fig. 39, *d*, *e*)=9·5 cm. (3·75 in.); *b.* From the most projecting part of the forehead to the chin, *i.e.* the length of the face=8 cm. (3 in.).

These measurements vary more or less in different individuals, and generally speaking are somewhat smaller in girls than in boys; the number of the pregnancy and the age of the mother influence especially the biparietal, the latter being also above the average in the children of multiparæ. Moreover individual peculiarities are met with, for instance well marked brachycephalic and dolichocephalic forms of skull, the former apparently being commonest in boys. Further, Fasbender's researches tend to show that the head of the child is a model of its mother's on a smaller scale[1].

The sutures, the fontanelles and the flexibility of the cranial bones make it possible not only for the head to alter its shape, but also for its volume to diminish, partly by an overlapping of the edges, and a mutual displacement of the bones, partly by their becoming flattened. This *mouldability* however is confined to the cranial vault; a line drawn from the supra-orbital ridge above the roots of the zygomatic arch, to the occipital protuberance divides the compressible part of the head from the incompressible part lying below it. The lessening of the volume of the cranium due to the cerebro-spinal fluid being squeezed into the central canal of the spinal cord, and possibly to the blood passing into the cervical veins, is not altogether unimportant; some diameters may be diminished to the extent of 1 cm. (·4 in.) or more. The trunk can to a far greater degree adapt itself to the shape of the parturient canal, for instance even the binacromial diameter can be diminished by 2 cm. (·75 in.).

The *mobility* of the head upon and with the cervical vertebræ, and indeed on all three axes, is of importance, and results from the flexibility of the still in part unossified vertebral column, and from the yielding character of the ligaments. Rotation round the vertical axis can without injury take place through a quarter of a circle, and even more, provided it occurs gradually. The movements on the horizontal axis are the most extensive, and since the articular surfaces which connect the head with the vertebral column are not exactly in the middle of the base, but lie nearer to the occipital region, the sagittal axis forms a lever a long anterior and a shorter posterior arm, an arrangement h explains the facility with which the head can be strongly d on the chest.

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[1] Grünbaum's measurements confirm those of Fasbender, and show that almost all the diameters of the fœtal head are to those of the maternal in about the proportion of ·6 : 1. (*Dissert.* Berlin, 1879.)

) *Attitude, Lie*[1], *and Position of the Fœtus in the Uterus.*

107. By *attitude* is understood the situation of the trunk, , and limbs of the fœtus relative to each other. Even the yo and the young fœtus present a well marked curve rds the abdominal aspect, and this primitive tendency to re is retained to the end of pregnancy. The longitudinal is invariably curved towards the ventral aspect, causing the r to present a concavity of varying depth, in which the lical cord usually floats. The head is strongly flexed, the resting on, or at any rate very near to the chest; the arms t the sides or in front of the thorax, the fore-arms being lly flexed and crossed in front of the chest; the knees are d, the legs, often crossed like the fore-arms, lie against the s, the latter being strongly adducted to the trunk; the m pedis is bent towards the shin, and the foot lies in ct with the inner and front surface of the leg; the two are slightly turned towards each other. These various of the body, however, are not pressed against each other, loat in the liquor amnii; only when the latter is very ent in quantity, are they to any extent squeezed one upon ier; under normal conditions the flexed attitude of the fœtus never be thought of as in any way enforced by the limited nmodation in the uterine cavity; such a view would imply stant pressure of the fœtal spine on the uterine wall, which not exist.

vertheless, while the limbs are conveniently disposed of, the body is reduced to the smallest compass. The whole has the shape of an ovoid, whose small end is formed by ead, the wider end by the lower part of the trunk with the l thighs. During the course of pregnancy, this attitude t uncommonly altered, although only very temporarily.

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[1] is term is not in general use. Some authors speak of "presentation," but this s inapplicable, for the presentation may vary, while the lie remains the same. therefore thought it best to use the word "lie," meaning by it, as Spiegelberg "Lage," the relation of the longitudinal axis of the fœtus to the axis of the or of the brim of the pelvis (Tr.).

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The movements of the limbs, which bring about the alteration, are also the means of restoring the original attitude, partly by reflex action, and partly by contractions of the uterus. With the advance of pregnancy, the attitude becomes more and more stable, owing to the diminished size of the uterine cavity relative to that of the fœtus. *Persistent marked deviations from the normal attitude only occur in dead fœtuses; with living ones they are practically restricted to the period of parturition.*

§ 108. By the *lie* of the fœtus, is meant the relation of its longitudinal axis to that of the uterine cavity. The two axes may entirely or approximately coincide (*longitudinal lie*), or intersect each other at a more or less acute angle (*transverse lie*).

During the first months, there is no definite lie, since the embryo is suspended by the umbilical cord, and is still very small in comparison to the cavity in which it is placed; yet even in the first half of pregnancy, the region of the shoulders and the head are usually found to be directed downwards. When the uterus begins to grow, especially in length, the fœtus which is likewise developing mainly in the direction of its length, will be embarrassed in every other except the longitudinal diameter of the uterine cavity, and the long axis of both will coincide more and more frequently, as pregnancy advances. The uterine wall, which is elastic, resisting and readily stimulated to contract, exerts an all round and equal pressure on its contents, the resultant of which must, from what we know of the shape of the uterus, coincide more or less with its longitudinal axis, and force the long axis of the fœtus into correspondence with it. If the fœtus abandons this lie, the walls of the uterus will be unequally stretched and mechanically irritated; contractions will follow, and these (when the proper shape is restored) as well as the reflex movements of the fœtus, to which they give rise (consisting of extensions and flexions of its limbs), push its trunk back into the longitudinal axis of the uterus. In this simple way the great frequency (amounting to 99 per cent. of mature fœtuses) of the longitudinal lie can be explained.

But the fœtus may have either its head or its breech lowest, while still in the longitudinal lie; the former, called the *cephalic lie*, is the commonest both during pregnancy and at its termination (in over 96 per cent. of all mature fœtuses).

Numerous hypotheses have been suggested to explain why the *cephalic lie is so frequent.* The one which has met with most support, although on the other hand it has provoked repeated opposition, is that which ascribes the cephalic lie to the force of gravity. This was in the earliest times assigned as the cause, but was given up, because various experiments appeared to show that the centre of gravity of the fœtus was not situated in its head, that another portion of its body, usually the upper dorsal region, sank lowest, when the fœtus was immersed in a vessel filled with fluid and of the shape of the uterus. It had however been forgotten, in making this experiment, that the point under discussion is why the cephalic end lies lowest in the uterus, not why that end presents (over the internal os). If the centre of gravity lies in the region of the shoulders, then the head must lie lowest when the uterus is vertical (which it approximately is, when the pregnant woman lies flat on her back), and still more when the woman is in the erect posture, since owing to the obliquity of the uterus in relation to the horizon (forming an angle of 35°), it is not the internal os but some low part of the anterior uterine wall which is now placed deepest; if the line of gravity of the fœtus falls upon it, the head must occupy the lowest part of the uterine cavity. So far the force of gravity can be made to explain the situation of the cephalic end, especially during the first part of pregnancy, in which the quantity of liquor amnii is relatively large, and the force of gravity can act undisturbed on the fœtus. There are however serious objections to the view that gravity is the principal cause of the head lying lowest: the fact that other observers have found the centre of gravity to be situated nearer to the pelvic end of the trunk; that in the lateral position of a pregnant woman, the superior segment of the uterus may sink to a lower level than the inferior, without the cephalic lie being altered; the fact that the cephalic lie becomes more and more frequent with advancing pregnancy, while the effect of the latter on gravity is to hinder its operation, owing to the relative amount of space in the uterus becoming more and more limited, and to the fœtus therefore meeting with support at numerous portions of the uterine wall; and finally the fact that the head is usually born first in other mammalia, especially in uniparæ, in whom the uterus is placed horizontally. It appears therefore as if the cephalic lie, which is so favourable to the successful termination of labour, were the result of a general natural law.

Although therefore the force of gravity cannot alone explain the frequency of the cephalic lie, it is certainly one of the causes. Amongst those that co-operate with it, the chief is to be found in the already mentioned similarity in form of the uterine cavity and fœtal body (co-adaptation). In the normal attitude of the fœtus in which all the limbs are flexed, the cephalic end is the smallest, the pelvic end with the lower limbs flexed upon it the largest; the fœtus therefore fills up the space at its disposal in the best and most convenient manner, when it lies with its head in the lower segment, and its breech in the fundus of the uterus[1]. If it abandons this situation, the higher specific gravity which the head attains after presenting for some time (in consequence of the increased pressure which the deeper layers of the liquor amnii and the column of blood have exerted upon it,—Lahs), the pressure of the uterine wall, especially when contracting (form-restitution force), the reflex (sc. extension) fœtal movements which are thus brought about, will restore the cephalic end to its former situation; and this will be the more stable, the longer it has lasted, the more completely the form of the uterine cavity and of the fœtus correspond, the more firmly the head is grasped by the lower segment of the uterus, and the greater the resistance and contractility of the uterine walls. Thus are to be explained the facts, that misshapen children are more often born in abnormal lies, that the latter are frequent where the uterine cavity is of irregular form, and are not uncommon where the quantity of liquor amnii is excessive, with premature births and with fœtuses that have died in utero. In the case of premature births however, it must never be forgotten that we have no right to conclude that the lie which existed *before* birth, was the same as that in which the fœtus is expelled.

§ 109. Since various factors contribute in producing and rendering permanent the cephalic lie, the constancy of the latter must be exposed to numerous exceptions during the last trimestrium of pregnancy.

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[1] In multiparous mammalia in which the fœtuses lie in *elliptical* ampullæ, cephalic and pelvic presentations are nearly balanced; and in such cases it matters not whether the head is directed forwards or backwards. (*cf.* Franck, *Thierärztl. Geburtshülfe*, 1876.)

Change of lie is as a matter of fact not uncommon. Long ago it was observed that the lie of the child was not always the same throughout the course of pregnancy, and the fact which has been mentioned, that premature fœtuses come into the world relatively often in a pelvic lie gave rise to the opinion, which was entertained as early as the time of Hippocrates, that the fœtus till about the 7th month always occupied the pelvic lie, and that this somewhat suddenly changed into the cephalic ("culbute"). When in the last century this doctrine was set aside, Scanzoni was the first to again declare in its favour (modifying it however in important points), and he showed that there was partial truth in it. Hecker and numerous disciples next showed that not only is the cephalic lie subject to frequent alteration right on to the end of pregnancy, indeed even during birth, but that any kind of lie may be changed at any period, so that such an event passed from the category of exceptional into that of ordinary occurrences. The commonest change is for a transverse to be transformed into a cephalic lie, the reverse occurring somewhat less often; the change from the pelvic into the cephalic lie is also relatively common, the opposite movement being somewhat rarer; it is very rare for a transverse lie to pass into a pelvic, and *vice versa*. Amongst the causes favourable to or promoting the changes just mentioned, are alterations in the posture of the pregnant woman, *i.e.* alteration of the surface which supports the weight of the fœtus, a relatively capacious uterine cavity, active and passive fœtal movements, uterine contractions and variations in the intra-abdominal pressure. The further pregnancy has advanced, the better established is the lie of the fœtus; still even during birth a change sometimes occurs, either in a favourable or in an unfavourable direction; indeed it is occasionally observed after rupture of the membranes. In multiparæ such an occurrence is more frequent than in primiparæ, with girls than with boys; contraction of the pelvis favours it (owing to the difficulty with which the presenting part becomes fixed in the brim before the commencement of labour); but unusual weight of the fœtus acts in an opposite direction.

§ 110. By the *position* of the fœtus, is meant the direction in which a definite fœtal surface (the dorsal is the one usually referred to) looks in reference to the sides of the uterus. In all the longitudinal lies, the back of the fœtus is most frequently turned to the left (for that reason called the first position), more rarely to the right (second position); in most cases of the first position, the back is also directed forwards; in the second backwards. In the transverse lie, the back usually looks to the front (first transverse position). The cause of the back being generally directed to the left side lies in the force of gravity. For since the right side of the fœtus has been found to sink lowest in the floating experiments that have been made, in the erect position of the pregnant woman the same right side must turn towards the anterior uterine wall (thus becoming the lowest), the back therefore being turned towards the left. To this must be added the fact that the uterus is not infrequently rotated to the right on its longitudinal axis, so that the lower half of its left side lies deepest, and as it is this against which the dorsum of the fœtus rests, the latter is also turned a little forwards. When on the other hand the woman lies flat on her back, gravitation directs the right side of the fœtus backwards and downwards, the back towards the right, and owing to the rotation of the uterus on its axis, frequently to the right and backwards. This also explains why, as is often observed, when the erect posture gives way to the dorsal, the first cranial position is frequently converted into the second, and *vice versa*. Such an alteration in the posture of the mother is the usual cause of the *change in position of the fœtus*, which change occurs even in an advanced state of labour, more frequently than the change of lie, especially with the cranial positions. As affecting the alterations of position during birth, must be mentioned the twisting or untwisting of any coils of the cord that encircle the trunk. When the back of the fœtus changes its position, it generally moves along the posterior uterine wall, although of course it does not follow that the constant position with the dorsum directed posteriorly, is the commonest during pregnancy (Sutugin).

(4) *Nutrition and Circulation of the Fœtus.*

§ **111.** The impregnated ovum derives its nutrition first of all from the cells of the tunica granulosa (which according to Lindgren pass through the pores of the zona pellucida into the interior of the ovum, and lead to an increase of the yolk-matter); next from the secretions of the mucous membrane of the oviducts and uterus, the ingredients of which by a process of osmosis pass through the external membrane of the ovum, and the primitive chorionic villi which before long spring up all over it, and mix with the yolk. When development has advanced further, the omphalo-mesenteric vessels take up the nutrient material contained in the yolk, and convey it to the embryo. When the allantois has brought the umbilical vessels to the chorion, and thus into intimate connection with the vascular spaces in the uterine mucous membrane, and the formation of the placenta and of the so-called secondary circulation has begun (3rd to 4th week), the interchange between maternal and fœtal blood proceeds in the manner described above, the latter taking up nutritive material from and giving back waste products to the former, while a mutual exchange of gaseous substances also takes place. This goes on till birth.

The maternal blood therefore represents for the fœtus the external world, from which its requirements of air and food-stuffs are simultaneously satisfied; there is abundant proof that nutrient material is not derived either from the liquor amnii, or from the secretion of the uterine glands. The existence of fœtal *respiration* and *metabolism* is demonstrated beyond doubt, by the proof of an independent production of heat (the temperature of the newly delivered fœtus is as a rule ·1°—·3° C. higher than the vaginal and uterine temperature of the mother); by the fact that lime is produced by the intra-uterine fœtus, while it is not found ready formed in the maternal blood; by the fœtal urine containing urea and uric acid[1], which cannot have been taken up from the maternal blood, since they have not yet been detected in any other portion of the fœtus than in the urinary passages, and by the muscular work of the fœtus (cardiac activity and movements of voluntary muscles). Further evidence is found in the fact that obstructions to and interference with the placental circulation rapidly cause death, that the fœtus generally first makes inspiratory efforts, and that fœtuses that have perished from this cause, present the signs of death by asphyxia or by drowning; conversely a child after birth ceases to breathe, when artificial apnœa is produced by supplying it with oxygen; moreover

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[1] Uric acid deposits are occasionally formed in the kidneys of the fœtus.

Pflüger has shown (and lately Zweifel has done so still more clearly) from the colour of the blood, that oxygen is consumed by the fœtus, and Zuntz has proved that oxygen may pass back to the mother, when her supply runs very short. Further, the rapidity with which the embryo attains to the size of the mature fœtus, is only intelligible on the assumption that active metabolism takes place, and especially that new material is supplied. The amount of oxygen consumed is of course *not very large*, for the fœtus is suspended in a fluid of a temperature closely resembling its own, and does not require any directly thermogenic substances. Its loss of heat by radiation is unimportant, and it loses no water by evaporation; moreover nourishment is conveyed to it in the form of arterialised blood, and therefore (leaving out of consideration the unimportant substances which get into its stomach when liquor amnii is swallowed) the digestive organs are idle; finally, the functional activity of all the organs except the heart is very slight. Nevertheless the consumption must go on *very rapidly*, since when the supply of oxygen is cut off, immediate symptoms of dyspnœa and suffocation come on; it may however be argued conversely from the latter occurrence, that the quantity of oxygen in the blood at any one moment is always relatively small.

Since the placental respiration must necessarily involve more than a mere exchange of free gases, it follows that the nourishment, the supply of formative material (with which the gases are associated) to the fœtal tissues from the maternal system, must also be effected by means of the placenta; in what way it passes, whether in solution or in a more definite form is uncertain; both modes are possible and probable[1].

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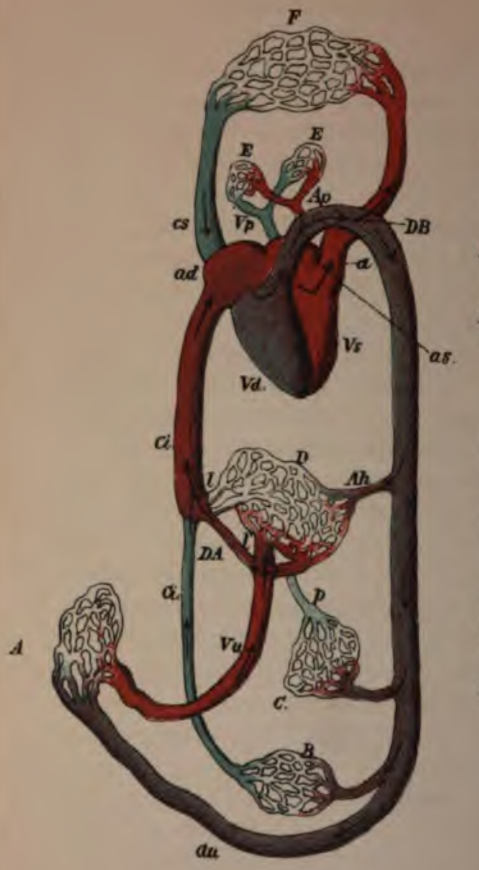
[1] The passage of *solid* matters out of the maternal blood (and perhaps the lymph,—Rauber) into the fœtal channels, has only been proved in the case of particles of cinnabar pigment, which had been injected into the maternal circulation (Reitz, *Centralbl. f. die med. Wissensch.*, 1868), but from what we know of the migration of white blood-corpuscles through closed capillaries, and from the experiments of Perls (*Allgemeine Pathologie*, ii., p. 266) is by no means improbable.

Matters in *solution* have been proved to pass into the fœtal circulation, in the case of the substances formed in acute yellow atrophy of the liver of the mother (Valenta, *Med. Jahrb.*, 1869); in the case of phosphoric acid, with phosphorus poisoning (Clouet, *Journ. de chim. méd.*, July, 1869); of iodide of potassium (Schauenstein u. Späth, Gusserow), of salicylic acid (Benicke and others), of chloroform (Zweifel), of benzoic acid (Gusserow), of acetate of copper (Clouet), of ferrocyanide of potassium, of potassium bromide, of potassium chlorate (Porak), of mercury, lead, arsenic, opium,



A. placenta.
B. circulation through the lower part of the body.
C. intestine.
D. liver.
EE. lungs.
F. circulation through the upper part of the body.
DA. ductus venosus Aranzi.
Vu. umbilical vein.
l. superior hepatic veins.
l' inferior hepatic veins.
p. vena portæ.
Ci. cava inferior.
Cs. cava superior.
ad. right auricle.
as. left auricle.
Vd. right ventricle.
Vs. left ventricle.
ap. pulmonary artery.
Vp. pulmonary vein.
Ah. hepatic artery.
Au. umbilical artery.
a. aorta.
DB. ductus Botalli.

Fig. 41.—Fœtal circulation. (Drawn by Strasser according to the description of Prof. Hasse.)

Red=arterial blood. *Violet*=mixed blood. *Blue*=venous blood.

§ 112. The *circulation* in the developed fœtus differs in mportant respects from that in the new-born babe, the peculirities depending on the circumstances that the lungs of the œtus are still inactive, the blood-flow through them being thereore very insignificant, and that most of the aortic blood is onveyed to the placenta, and from this returns to the vena cava nferior. Some arrangement therefore becomes necessary, by hich the blood shall be diverted from the pulmonary arteries, nd a communication established between the umbilical vein and e vena cava inferior.

In order to understand the course of the circulation under such nditions, we will begin at the filling of the *cardiac auricles* g. 41): the blood which has been arterialised in the placenta, ws through the *umbilical vein* to the fœtus. This vein enters e body of the latter at the umbilical ring, runs along the terior edge of the suspensory ligament of the liver, to the left ngitudinal sulcus of the liver, and there divides into two anches; the larger one unites with the vena portæ, and passes th it to the liver, the smaller short branch placed further back, s as early as the 7th and 8th months a very small transverse tion, and at once joins the vena cava inferior. It constitutes e *ductus venosus Aranzi.* The vena cava inferior, after collectg the blood from the lower extremities, abdomen and umbilical in, enters the right auricle, which at the same time receives e blood which is returning from the upper half of the body. e pulmonary veins however at this time convey but very little ood to the left auricle, and it is therefore incompletely filled; e right auricle on the contrary being over-distended, the blood reams out of it through the *foramen ovale* (which is situated in e inter-auricular septum) into the left, till both become equally led; this equal repletion is moreover materially facilitated by e direction of the *Eustachian valve* which guides the blood of e vena cava inferior directly to the foramen ovale, and of the *lve of the latter*, which on the side of the left auricle has become

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Moreover it is a well established fact that several kinds of contagia are transted from mother to fœtus (especially the poison of variola).

Little is known as regards the return of material from the fœtus to the mother; but re can be no doubt that it takes place as far as the ordinary waste products are cerned. Savory and Gusserow moreover have proved that foreign matters may pass over into the mother (*l. c.*).

adherent to a large part of the circumference of the foramen, and thus probably permits the flow from the right side to the left, but not in the contrary direction.

The contractions of the auricles fill both ventricles equally, the contractions of the latter fill the aorta and the trunk of the pulmonary artery. Since however only a very small quantity of blood can pass from the latter into the pulmonary branches, the greatest portion of it flows into the aorta, through a blood-vessel which forms a continuation of the pulmonary arterial trunk (beyond the point at which two pulmonary arteries are given off) and passes without diminishing in size to the concave side of the aortic arch; it is called the *ductus arteriosus Botalli.* But the aorta now receives more blood than it requires for supplying the various parts of the body, and therefore sends the excess through the hypogastric arteries and their largest branches, the *umbilical arteries*, to the placenta. These arteries are covered by peritoneum, and run along the lateral walls of the small pelvis, by the side of the bladder to its summit; from there they accompany the urachus (converging as they do so) to the umbilical opening, where they meet with the umbilical vein, and run with it into the cord (fig. 41).

It must be noticed that the arterialised blood returning from the placenta, only reaches the heart after at any rate its larger portion has traversed the liver (where it probably undergoes important changes), and after having been mixed with the venous blood from the lower half of the body. In the heart it is further mixed with the venous blood coming from the head and upper extremities; this however only happens to a slight extent; for the two columns of blood passing into the right auricle from the superior and inferior vena cava, are soon led off in different directions mainly by the Eustachian valve. This valve arises from the anterior inferior edge of the orifice of the inferior cava, and directs the arterialised blood of the latter straight into the left auricle; from there the blood is driven through the left ventricle into the first part of the aorta, and flows to the head and upper extremities, by means of the large arteries which spring from the aorta, and supply those regions; only a small portion enters the descending aorta. The blood of the superior cava on the other hand flows almost entirely into the right ventricle, and from this through the trunk of the pulmonary artery and the ductus Botalli into the descending aorta, and so into the umbilical arteries. Thus the head is mainly supplied by arterialised blood, an important matter for maintaining the apnœic condition of the fœtus; the lower extremities and the umbilical arteries receive the venous blood returning from the head. Perhaps this arrangement is connected with the predominant development of the upper part of the body and head, which is so very noticeable in the first half of fœtal life, but which persists to some extent after birth. The lower extremities in new-born and suckling children are comparatively inactive, and their muscles are feeble; suckling on the other hand requires that the arms and brachial muscles be strong so as to seize the nipple.

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SECTION III.

THE DIAGNOSIS OF PREGNANCY.

§ 113. The changes which have been described in the two previous chapters, namely those produced by pregnancy in the maternal organism, and those occurring in the impregnated ovum, to which two fresh ones, soon to be mentioned, must be added, are signs of pregnancy, inasmuch as they enable us to recognise that condition and to answer questions relating to it. This is the province of diagnosis, one of the most important and difficult departments of practice, and one which can only thoroughly be mastered with the assistance of a well informed mind, great tact and manual skill, as is shown by the lamentable mistakes which occur so often. The results of treatment depend greatly on a complete diagnosis in every department of medicine, but this is specially true in midwifery, inasmuch as treatment must be entirely guided by the diagnosis.

It is not sufficient for the accoucheur to know the signs of pregnancy and their relative value; he must be able to detect them, or to satisfy himself of their absence. This is done by means of the so-called obstetrical examination. Its full description is mainly the subject for clinical instruction; a text book can only deal with the general procedure to be adopted.

a. The Obstetrical Examination.

§ 114. This examination must always be preceded by an *interrogation* of the woman. The first glance at her is sufficient to furnish an approximate opinion as to the shape of her body, her attitude and constitution, but the interrogation must go further, and throw light on all points connected with the puerperal condition as well as on the subjective symptoms; for instance, morbid conditions of the generative organs, the course of previous confinements, the regularity &c., of the menstrual periods are facts of the highest importance.

The examination itself may be divided into the *external* and the *internal*. Both are equally important, but the external gives most information, and should for that reason always precede the internal. The latter moreover is greatly facilitated by simultaneous external manipulations (*bimanual examination*), and only when thus combined, does it give satisfactory information. A complete and accurate examination can only be made in the *dorsal position*. An exploration of a woman in the *erect posture* (in which the observer lets himself down on one knee in front of his patient, and passes his free hand round her waist with the object of steadying it), is only occasionally of service by bringing the abdominal contents or the uterus nearer to the finger, which is examining *per vaginam*, an advantage which the tense condition of the perinæal muscles (in the erect posture) for the most part annuls, and which is more than counterbalanced by the tension of the abdominal walls making a simultaneous external examination impossible. In consequence of the relaxation of the pelvic and abdominal muscles in the dorsal position, the finger can always reach further into the genital canal than in the erect position, and it is only in the former that the pelvic cavity can be completely explored. For this reason the dorsal position should always be preferred in the first instance. Lateral and knee-elbow postures are fitted for exceptional cases, which will be dealt with in the proper place.

The woman must lie quite flat on her back, the shoulders being at most only a very little higher than the pelvis; the head may be raised on a pillow. The knees should be flexed till the legs are perpendicular, or nearly so, to the couch, and they must be at least about ·5 m. (20 in.) from each other. In this way the highest possible degree of relaxation of the abdominal walls and of the perinæal region is obtained, as well as the easiest and least unpleasant access to the genitals. Any clothing that is in the way, must of course be removed or sufficiently loosened, and on no account must the bladder be distended during the examination. To spare the woman's feelings as much as possible, her abdomen should be covered with the chemise, and only exposed when absolutely unavoidable.

(1) *External Examination.*

§ 115. The external examination deals with the breasts and the abdomen, and consists of inspection and palpation, with the occasional help of percussion and auscultation.

The *breasts* are examined either in order to discover changes due to pregnancy, or to make sure of their suitability for suckling. Their general development will therefore be noted, and especially that of the glandular portion; also the extent and intensity of the pigmentation, and the development of the glands of the areola; the contractility of the latter and of the nipple, and the presence of secretion (which will exude if the gland and the areola are compressed with two or three fingers). Firm and extensive pressure is not so unpleasant as much superficial manipulation. The whole investigation occupies less than a minute.

The examination of the *abdomen* is made with the object of discovering its size, the degree and the cause of any enlargement that may be found; of obtaining information in reference to the form and position of the uterus and to its contents; of ascertaining the living condition, the lie and the position of the fœtus. Of course the condition of the walls is also important. Inspection does not help very much, although it reveals the size and shape of the abdomen, the pigmentation, elasticity, and striæ of its walls, and the state of the navel. We get most help from palpation and auscultation.

§ 116. In order to *palpate* the abdomen, the accoucheur should let the woman lie flat on her back, and, while standing on one side of her, place both hands (with adducted fingers) flat on the abdomen, which must be either bare or covered with only one garment; he then applies gentle but firm pressure, so as to form an opinion in regard to the enlargement of the abdomen and its contents. When he has in this way made out and defined the uterus, and the fœtus contained in it, his two hands are to be laid at the sides of the uterus, so as accurately to explore its boundaries, its shape and mobility, the tension of its wall and finally the condition of its contents. He should next place his hands on the upper portion of the uterus, the fingers directed towards the pelvis, and carefully palpate the whole of this region; when this has been done, he turns himself and his hands, and places them immediately above the pelvis at the lower portion of the uterus, and proceeds in a like manner towards the fundus uteri, his fingers pointing upwards. While making this investigation, the hand should lie flat, and the fingers be approximated; their tips must never be buried in the soft parts. If it is wished to examine one spot or a larger area more minutely, this is to be steadied with the wrist of one hand, and felt with the finger tips of the other, the region in question being meanwhile prevented by the wrist from gliding away. Not only should the fingers of the hand and the wrist act in unison though in contrary directions, but one hand must co-operate with the other; the two hands are therefore alternately to be pressed deeply into the abdominal walls, in such way that one hand always gives a fixed surface on which the portion of the abdominal contents under examination can be explored and moved by the other. By these means it is possible to obtain very accurate information in regard to the size, shape, lie, attitude, mobility and movements of the fœtus and of the several parts of its body. When a considerable part of the fœtus moves to and fro, and glides between the two hands, it undergoes what is called *ballotement*. In carrying out this manœuvre, it is well not to be too timid; firm manipulation and pressure, as long as they are done gradually and steadily, are not so unpleasant as frequent and irregular superficial handling. By diverting the attention of the woman, and by allowing her to make quiet and deep inspiratory movements, while a steady pressure is exerted, the tension of the abdominal walls can usually be overcome. Very great thickness however and considerable mechanical tension may prevent the palpation giving information as to the case.

Under such circumstances, as well as when the wall of the uterus is very relaxed and yielding, *percussion* is a good method of defining the outline of the uterus, its relation to the intestine, its position and shape; it is of special value for differential diagnosis. Percussion is to be practised according to a definite system, and may precede or follow on palpation, as circumstances indicate; it is well first to percuss from above downwards in the middle, the mammary and the axillary lines, and then the several abdominal regions may be examined one after the other in a horizontal direction.

Occasionally (and such cases are usually difficult to diagnose) the prominent abdominal walls are so tense and hyperæsthetic, as totally to prevent palpation; or individual abdominal muscles contract, or separate divisions of the recti do so, forming such distinct swellings, as to simulate the fœtal parts and movements; nor does percussion yield as clear a result as could be desired. In such instances, *chloroform anæsthesia* is a certain means of relaxing the abdominal walls, of diminishing the size of the abdomen, and of enabling a successful palpation to be made. But firm and steady comprehensive pressure on the abdomen, exerted especially during expiration, though continued during inspiration, almost always enables us to obtain our object without chloroform.

§ 117. In *auscultating* the abdomen of a pregnant woman, various sounds are heard, apart from accidental intestinal noises, the aortic beat, and any fœtal movements that may be conducted to the ear. They are (1) a systolic murmur arising in the maternal vessels, and called the *uterine souffle;* (2) the double beat of the fœtal heart or *fœtal pulse;* occasionally also (3) a blowing sound isochronous with the latter, the *umbilical souffle.* The value of auscultation in obstetrical practice was pointed out by Laennec, although Major in Geneva (who in 1818 described the fœtal heart-beat), and Lejumeau de Kergaradec (1822) were the first to establish its real importance; it has become one of the most useful means of diagnosis. Auscultation is usually practised with the help of a stethoscope; this is more convenient than the direct apposition of the ear to the abdomen, less apt to wound the woman's feelings, and is less unpleasant for the practitioner, especially in the case of individuals who are not very cleanly. Moreover the exact spot where the signs sought for are audible, can be more accurately fixed with the tube, and the ear is less disturbed by other sounds in the vicinity. Direct auscultation may sometimes be employed in the first place in order to settle the question whether any auscultatory signs are present.

The Uterine Souffle.

§ 118. The uterine souffle, formerly also called placental souffle, is a blowing, purring or whizzing noise, isochronous with the maternal pulse, and similar to that heard over a varicose aneurism. It arises in the arteries running at the sides of the lower segment of the uterus and entering its parenchyma at that portion, as well as in their ramifications in the uterine tissues; it may possibly also arise at the points where the arteries open into larger veins. Hence it is generally heard over a variable area at the sides of the uterus, especially at the side which is most turned forwards, though occasionally also over the fundus and the anterior surface of the body. Its situation often changes with the position of the pregnant woman and her uterus. The souffle keeps pace with oscillations in the rate of the maternal pulse, and when the latter is very frequent, may appear to be a continuous bruit, the intervals having disappeared. When the uterus contracts, the note becomes higher, musical and whizzing; at the height of a strong uterine contraction, it ceases, reappearing when the latter comes to an end. I have also found it loud and whizzing, where the uterine walls were greatly distended by a large amount of liquor amnii. It may be greatly modified, and even silenced by the pressure of the stethoscope.

The uterine souffle arises, as already observed, in the branches of the uterine arteries which pass up at the sides of the cervix, also in the descending branches of the ovarian arteries, especially at the spots where these penetrate into the uterine parenchyma. This is owing to the fact that the transverse section of these vessels is much greater than that of the original trunks, and that their course is very tortuous and spiral, so that all the physical conditions for the origination of bruits are present. The same conditions are also present at the various points within the uterine wall, where arteries open into veins or their sinuses; and since the latter occurs mainly at the placental site and in its proximity, the bruit has probably some relation to the placenta, especially in those instances in which it is heard not

e sides, but at the upper wall of the uterus; it does not
nate in the placenta itself. This explanation not only
rds with the above-mentioned conditions, under which the
t is present, and particularly with its behaviour during
ine contractions, as well as with its persistence after delivery,
it is directly confirmed by the fact that it is not rare to feel
cervicem (after its dilatation) and above the vaginal fornix,
een it and the lower segment of the uterus, whizzing arteries
he side on which the bruit is audible; the continuity of the
zing with the pulsating arteries of the lower segment of the
us can sometimes be distinctly made out, and the whizzing
f may be suppressed by firm digital pressure. Thus the
er feels what the ear hears. This bruit can also sometimes
ilenced in the case of women recently confined, by pressing
he common iliacs through the abdominal walls.

very rare cases the souffle is of extra-uterine origin, and
ed by the whizzing of the stretched inferior epigastric
ies (Kiwisch). But it is never produced by the sides of
uterus pressing on the great pelvic and abdominal arteries, as
illaud believed; such pressure is as a rule not present during
nancy, and when it does exist, as with very voluminous
ours encroaching upon every part of the pelvic and abdominal
ies, the bruit is absent.

quite exceptional cases, the souffle is a continuous sound
similar to the bruits heard in the external jugular), and is
d extensively over the uterus; when this is so, it probably
inates in the superficial veins of the uterine wall (Dubois).

he uterine souffle is rarely heard before the 4th month, since
uterus can scarcely be reached with the stethoscope at an
er period; with lax non-resistant and thin abdominal walls
ever, it may occasionally be perceived as early as the 3rd
th. Indeed I have heard it several times under the above
itions as early as the 8th to 9th week, but at this early
od the stethoscope must be pressed down deeply at the upper
of the anterior pelvic wall, not far from the symphysis,
rder that it may reach the sides of the lower half of the
us. The souffle is at all times, but especially at this early
od, a valuable indication of pregnancy.

hen the uterus is emptied at the time of labour, the souffle
not immediately disappear, but may be perceived for several

days (at most six) with a steadily diminishing intensity; sometimes if the uterine walls begin to relax, it becomes for a short time very distinct; this observation, which I have repeatedly made, is explicable by the seat and mode of origin, which have been mentioned above, for of course the uterine vessels do not regain their original size instantaneously.

The Fœtal Heart-Sounds and the Umbilical Souffle.

§ 119. The fœtal heart-sounds (fœtal pulse) are heard as a regular quick double beat, with a frequency of 120—180 in the minute. The sounds resemble the tic-tac of a watch buried in a pillow, and the best idea of their character is got by auscultating the heart of a new-born child; occasionally one sound is so weak or obscured, that only a single beat is audible. The fœtal heart-beat is heard most distinctly over the area with which the back of the fœtus is in contact, consequently most often on the left side at the level of the umbilicus and below it; when the fœtus is placed in a dorso-posterior position, it is heard most distinctly in the proximity of its breech. The situation in which the fœtal pulse is heard, varies with changes in the lie and position of the fœtus. In the earlier months of pregnancy, the sounds are as a rule weaker and more rapid (owing to the imperfect development of the fœtus) than in the later months, and owing to the comparatively large quantity of liquor amnii, can only be heard with great difficulty and over a very limited area, while in advanced pregnancy they are better conducted and heard over a wider area. Thick abdominal walls, abundance of liquor amnii, a fœtal position in which the back looks towards the posterior wall of the uterus, are obstacles to the sounds being perceived; yet when the fœtus is living, they can always be made out on a repeated, if not on the first examination. As a rule they are audible from the 18th—20th week onwards, but it is not uncommon (*i.e.* when conditions are favourable for conducting the sounds) to hear them as early as the 15th—16th week.

The fœtal heart-sounds vary greatly in intensity and frequency. Broadly speaking, it is true that females have a somewhat higher rate than males, and that a greater development in size is accompanied by a somewhat diminished frequency, but in an isolated case, this is not often enough true to be of use. The force of the heart-beat varies little in the *same* case, but the reverse is true of the frequency. The average rate, or so-called normal frequency, can only be determined when the mother as well as the fœtus are at perfect rest, for the frequency increases with every fœtal movement, whether active or passive, soon however returning to the normal, when the movement is at an end. In the case of passive movements, the change in rate depends on active fœtal movements provoked by the passive. The increase in frequency (lasting but a short time) which not uncommonly accompanies the commencement of a pain, especially after the discharge of the liquor amnii, can also be referred to fœtal movements. At the acme of an *expulsive pain* on the other hand, the fœtal pulse is often greatly slowed, indeed it may for a moment be brought to a standstill; either as a result of the pressure which affects the whole body, and therefore compresses the thorax, and retards or momentarily stops the cardiac action; or (and this probably the usual cause) as a result of the compression of the contents of the cranium due to an alteration in its shape, by which the points of origin of the vagi are stimulated; under such circumstances, if the other conditions are normal, the average rate reappears during the interval between the pains. Disturbances in the circulation of the mother, and above all fever, affect, *i.e.* accelerate the rate of the fœtal heart-beat.

§ 120. The *umbilical souffle* is a blowing or hissing sound, which is synchronous with the fœtal cardiac sounds, and heard either in the place of those sounds, or in addition to the clear heart-beat; in the latter case it is heard in immediate proximity to that sound and almost always over the dorsum of the child. It is not very rare, occurring in 10—12 per cent. of all cases, and is met with both in pregnant and in parturient women; in the latter usually before the bursting of the membranes. The umbilical souffle varies greatly, disappearing temporarily and again reappearing; thus it may be perceived before the bursting of the membranes, and cease when the liquor amnii is discharged; while in other cases it only appears after such discharge.

The souffle very rarely, if ever, originates in the fœtal heart. Its liability to vary, the fact of its being heard side by side with clear cardiac sounds, and the infrequency of cardiac murmurs in new-born children, are opposed to any such view. It more probably originates in the umbilical cord, in which the conditions necessary for the production of arterial murmurs (high tension, great obstruction to the blood-flow, valvelike bends of the canal, wavelike movement of the blood in the vessels) are so frequently present. If the cord happens to be very short, or coiled round the fœtus and therefore subjected to considerable stretching, compression of the coiled cord against a broad part of the child (back or side) gives rise to the souffle. The fact that in many cases where the souffle is present, no coils are found, does not disprove the above view of its origin, inasmuch as the coils may have been unwound before or during birth. I have in a series of cases observed a previously audible souffle disappear with a change in the fœtal position, the coiled cord having probably been unwound, or loosened, or become less stretched owing to rotations of the fœtus. The disappearance of the souffle after the discharge of the liquor amnii, is most easily explained by the diminished tightness of the cord resulting from the corresponding diminution of the uterine cavity, and the approximation of the placental end of the cord to the fœtus. As settling the question that the umbilical cord is the seat of origin of the souffle, may be mentioned those cases of prolapsed cord, in which it is produced by such changes in the circulation of the cord as are easy of demonstration; such instances are on record[1].

The souffle has no practical value as a sign of pregnancy. It is too uncertain and changeable for that purpose; but it may have some influence on prognosis. The disturbances however which it indicates (*e.g.* pressure on the umbilical cord), are either too insignificant, or else are soon made clear through other and more definite symptoms; still if the souffle is heard after the bursting of the membranes, it is safe to conclude that some obstruction to the circulation through the cord is present.

Nauche, Keiller, and recently Verardini have constructed instruments (metr scope, vagino-uteroscope) for directly auscultating the portio vaginalis and th

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[1] In a case in which the cord could be felt between the abdominal and uterine wa and the fœtal body, Kehrer (*Arch. f. Gynækologie*, xii., p. 258) succeeded by pressure with the stethoscope in producing a systolic bruit, instead of the clear

lower segment of the uterus, and it is said that by means of this *intra-vaginal* auscultation, the vascular bruits of the uterus, and the fœtal movements can be perceived at a very early period; but the difficulty and complexity of the method, the dislike that pregnant women evince to it, the irritation of the genital canal associated with it, are too much out of proportion to the poor results it yields, to bring it into general use. The attempts which I have made with the metroscope to auscultate the presenting head during labour, have brought me to the same conclusion.

(2) *Internal Examination.*

§ 121. The internal or *digital examination* consists in exploring the genital canal and the lower segment of the uterus by means of the hand; the use of the *sound* is only admissible in the case of a pregnant or lying-in woman under very exceptional circumstances. Broadly speaking, the same is true of *inspection* of the internal genital organs, and it is only occasionally resorted to, in order to obtain accurate information of their colour or to detect a diseased state of the cervix. An ordinary speculum is to be preferred; a Sims', applied in the latero-prone posture, is not so well adapted for the purpose, owing to the width and folds of the vagina, and to the high position of the portio vaginalis.

It is the *digital* which is *par excellence* the obstetrical examination, and the finger tips have been termed the eyes of the accoucheur. This examination does not, as already mentioned, rank higher than the external, but for the unskilled it is more difficult, since the exploring hand has not the eye to guide it. It therefore requires much practice, and to obtain this it is requisite to begin by strictly adhering to a definite plan. The patient must lie perfectly flat, and on no account must her pelvis sink into the couch; her knees must be bent, and moderately separated. It is best for the accoucheur not to stand at the edge of the couch, but to sit on it or on an adjacent stool, so that he ooks towards the face of the patient; it is only when he is thus laced that the fore-arm of the exploring hand can be held in the xis of the body of the pregnant woman, and rest easily on the ouch between her thighs. It is needless to point out that nless the accoucheur be ambidexter, he will often be puzzled nd awkward; the necessity for his being so is shown by the act that he cannot always choose the side at which the patient is to be approached. If he has the choice, the use of the left hand as the thinner and softer is usually to be recommended.

The index finger must next be introduced into the hitherto unexplored genital canal. For this purpose the thumb is extended and abducted, the remaining four fingers are flexed, placed with the radial side of the index on the perinæum, and drawn forwards between the labia; in this way all unnecessary and unpleasant manipulation about the vulva, or even vexatious mistakes are avoided. If the index finger has reached the vaginal orifice, the thumb is either placed on the mons Veneris, or on one of the labia majora, the last three fingers are flexed in the palm, and the whole length of the fore-arm rests on the couch in a line with the longitudinal axis of the patient. It will soon be seen whether, without causing the woman much discomfort, the middle finger can also be introduced, as is almost always the case; the advantages are not only that the middle finger can reach higher, but that a simultaneous exploration of two spots lying apart becomes possible, and a clearer idea of their relations is thus gained. The exploring fingers next glide upwards along the posterior vaginal wall, and endeavour in turn to reach all the other portions; if there is difficulty in reaching some of them, this may usually be overcome by pushing the yielding and but little sensitive perinæum backwards and upwards, while at the same time the thumb is flexed in the palm of the hand, and the patient slightly raises her pelvis.

During the exploration every organ must in turn be felt by the finger, beginning with those at the vulva, and advancing towards the uterus and the presenting part of the child; in this way nothing will be omitted. The frænulum, perinæum, and hymeneal remains, the urethral orifice and the urethro-vaginal wall will be noticed; also the condition of the vagina, whether hypertrophied, thrown into folds, or softened; also the amount of secretion and the condition of its surface; the cervix demands attention, especially its position and direction, its shape, length, softness and patency; then the lower portion of the body of the uterus as regards size, elasticity and tension, and its contents, especially the presenting portion of the fœtus; the finger should advance by regular stages from below upwards, pass from the posterior to the lateral vaginal walls, and also sweep in a circle round the whole canal. That the state of the bladder, rectum, pelvic cellular tissue and bony pelvis, must not be omitted, is self-evident.

§ 122. When two fingers are insufficient for the examination, four fingers (*half the hand*) or the *whole hand* may be used; in this case however the whole hand must not be introduced at once, but first the index and middle finger, then the two last fingers, and finally the thumb, or this may be flexed in the palm; when the greatest width of the hand (disposed in such a way as to form a cone) has passed the vulva, it must be turned transversely with its back towards the perinæum, and the latter be firmly pushed towards the anus. This examination is as a rule only made during labour, when the generative organs are thoroughly infiltrated, in order to make the most accurate exploration possible of the pelvis and the relations of the fœtus to it; or during pregnancy to measure the pelvis, or to discover some very obscure condition. When the examination is unusually difficult or painful, the woman must be chloroformed.

§ 123. Simultaneous palpation *per vaginam* and *per hypogastrium*, *i.e.* the *bimanual examination*, is usually only employed after the two parts have been gone through separately; but sometimes after a completed external examination, the bimanual is immediately resorted to. In it the hand on the abdomen always co-operates with the fingers in the vagina, and if this is made to penetrate deeply into the abdominal and pelvic cavities, the contents of the latter cavity may be grasped between the two hands, and closely examined. During the second half of pregnancy and during labour, this method of exploration has only a secondary value, and serves mainly to fix the uterus and the fœtus in reference to the pelvis, but it is all the more important in the first months for estimating the position, size, shape and consistence of the uterus, for distinguishing it from other tumours, and for forming an opinion as regards the condition of its appendages. If while the uterus is grasped between the two hands, its contents are alternately pushed up and down, and thus thrown into motion, it is often possible at a very early date to perceive that motion, the ballotement of the fœtus.

The *investigation per rectum* is of secondary obstetrical importance, and can only take the place of that *per vaginam*, where the vagina is occluded or greatly narrowed, or is diseased in such a way as to render any vaginal examination inadmissible. It may also be of use in displacements of the uterus, in the case of tumours &c., and be combined with external palpation (combined recto-abdominal examination). The exploration *per rectum* is always made first with one finger, but the middle finger may also be introduced without doing any harm; before this examination is made, the rectum should be washed out.

b. Diagnostic Value of the Various Signs of Pregnancy.

§ 124. When a woman is examined with regard to the existence of pregnancy, the following questions have generally to be answered:—

1. Is she pregnant? 2. What period of pregnancy has she reached? 3. Is hers a first or a subsequent pregnancy? 4. Is the fœtus alive or not? All other questions are of too special a character to be dealt with here, but the answer to these four depends upon a discovery of the changes already described, and on a discriminating judgment as to their value.

(1) *The Various Signs of Pregnancy.*

§ 125. The phenomena caused by pregnancy are either subjective or objective; of the first we derive information from the account given by the woman herself, the latter we discover by physical examination. To the first belong all the changes affecting the organism as a whole, whether they show themselves as disturbances in the general health or in definite organs, such as the nervous centres or tracts, in the digestive, secretory or circulatory system. There are some that deserve special attention, viz., abnormal sensations in the generative organs, especially in the breasts, the cessation of the menses, and the perception of fœtal movements. To the objective belong all the phenomena which can be seen, felt and heard in the generative apparatus and its vicinity.

It is obvious that these signs are not all of equal assistance, in making a diagnosis as to whether a woman is pregnant or not. They may from this point of view be divided into three well defined groups. The first includes the signs which make us suspect the existence of pregnancy (*grounds for suspicion*); the second those which make pregnancy more or less probable (*grounds for an opinion*); the third those which convert our opinion into an absolute certainty (*grounds for certainty*).

§ 126. The *grounds for suspicion* consist in the main of the subjective phenomena, with the exception of the arrest of the menses, and of those objective ones which show themselves in organs which have no direct connection with the generative system. They are most distinct during the first months, although very unreliable and temporary; moreover they occur with much the same characters in various diseased conditions of the sexual organs. On the other hand conception sometimes causes such slight disturbances of the general health, that these are of no value for diagnostic purposes. Again it must be borne in mind that pregnancy not uncommonly supervenes when the system has been affected for some time by illness, so that it is impossible to say whether the presence or absence of the subjective signs of pregnancy, is to be ascribed to the latter, or to the illness. Especially must I warn the practitioner against relying too much on the subjective perception of fœtal movements, or abnormal sensations in the breasts, or on statements as to the enlargement of the latter and of the abdomen. These last indications (which must be classed among the objective) are highly fallacious; for the size of the abdomen may greatly increase (without any special organ becoming enlarged, and without any pathological collection being present) owing to an abnormal accumulation of fat in the walls or to flatulence. Swelling of the breasts and the peculiar sensations in them which accompany pregnancy, occur not only as a result of irritation of the internal generative organs, but also in consequence of central influences, especially, as I have frequently noticed, in young childless women, in whom the wish to become mothers is the central idea of their life. Such women are very apt to present considerable flatulent prominence of the abdominal walls, and frequently declare that they have felt fœtal movements. The latter error may have no objective foundation, but depend on a purely central irritation; as a rule however it arises from a subjective perception of intestinal movements (indeed they become objective when the abdominal walls are thin), or from such local contractions of separate divisions of the recti, as are specially common in querulous, so-called hysterical women, and are sometimes visible to the eye of the observer. In certain rare cases, I have seen separate nodules of a multiple myoma of the uterus or of an ovarian cyst, mistaken by the patient for fœtal parts, and the passive movements of those masses for fœtal movements. We can therefore only rely that *fœtal movements* have actually been felt, where we are certain of feeling *fœtal parts*, and as it is the latter sign on which we base our conclusion, the former sinks into the background, and is valueless in itself.

§ 127. The signs belonging to the third group, those which make the existence of pregnancy *certain*, are the most definite, for they include only such phenomena as yield objective information of the presence of the fœtus (which is proof of pregnancy), viz. the *feeling of fœtal parts* and fœtal movements, and the *hearing of the fœtal heart-beat*. When even one of these signs is discovered beyond doubt, the question of pregnancy is *ipso facto* solved, however numerous and persuasive any objections and assertions may be. It is of course possible for an observer to be deceived in recognising these signs. For instance, a very rapid maternal abdominal pulse or the maternal cardiac sounds, still more frequently the observer's own pulse (which has increased in rate and become audible owing to the pressure of the stethoscope against the temporal artery) may be mistaken for the fœtal heart-beat, and displaceable or even floating abdominal masses for parts of the fœtus; but a careful observer will not allow himself to be long deceived. I may however again point out that the fœtal parts are subject to "ballotement" (*cf.* above, § 116), that they are therefore floating in an encysted fluid, and that their nature may as a rule be recognised by their form and mutual relations. The *perception of movements* by the observer is therefore of quite secondary importance for the diagnosis of pregnancy, since it presupposes the existence of fœtal parts, and this latter sign is sufficient; if they cannot be felt, the remarks made in the previous section, in regard to a subjective perception of fœtal movements, holds good, even when these have been perceived by the accoucheur.

There are *only two certain* signs of pregnancy, the discovery of fœtal parts, and hearing the fœtal pulse. But they only decide the affirmative side of the question; we cannot at once conclude that pregnancy does not exist, when they appear to be absent or cannot be discovered.

§ 128. In such cases, as well as during the first half of pregnancy, in which the grounds for assurance can at best only be perceived towards its close, we are restricted to the second group of signs, those which make the existence of pregnancy *probable*. To them belong the cessation of the menses, and the changes in the sexual organs, including the uterine souffle (which have been described in §§ 66—75), in the abdominal walls and the breasts. It is true that these phenomena accompany with rare exceptions every pregnancy; but any one of them may be absent, or so indistinctly marked as to be valueless, and occasionally they also appear in diseased conditions of the sexual organs; least of all is any one of the phenomena taken singly, sufficient to justify the diagnosis of pregnancy, although when hey are all present, there can be very little doubt.

The most valuable of these signs are the suppression of the menses, the characteristic enlargement of the uterus, the infiltraion and changes in the colour of the external genitals, vagina, nd cervix; the uterine souffle; the hypertrophy of the abdominal walls and the flaccid state of the no longer depressed (possibly even prominent) navel; the alterations in the areola, and the presence of mammary secretion.

§ 129. The *suppression of the menses* is a very valuable sign, when it occurs in a sexually mature person, who has not been exposed to any injurious conditions, and in whom no evidence of pelvic disease can be detected, that is, when it is unaccompanied by any obvious or sufficient cause. It becomes still more important when the cessation has already lasted several months, and the uterus at the same time appears enlarged; for the catamenia are rarely absent when the enlargement is due to disease, they tend rather to become irregular or profuse. Conversely, we shall seldom be wrong in considering a person who menstruates fairly regularly, as not pregnant (*cf.* § 72).

Although the uterus may increase in size from a variety of causes, the *enlargement* due to pregnancy differs so characteristically from that due to disease, in shape, mobility, and consistence (§§ 65, 66), that a gravid uterus may almost always be recognised by these peculiarities, and be confidently diagnosed from other kinds of enlargement, and this is especially true of the first half of pregnancy. In the second half, in which as a rule we have "grounds for assurance" to help us, weight is only to be attached to the form of the uterus, when owing to its great distention by abundance of liquor amnii, or owing to displacement, the signs showing the presence of a fœtus cannot be perceived. In such cases in addition to the characters already mentioned, we not infrequently have the presence of uterine contractions (a hardening with subsequent relaxation) arising either spontaneously or after palpation, and settling the question. Even in the first months bimanual palpation may provoke contractions; but at that period I consider the shape, position, and consistence of the uterus as diagnostic. The peculiar anteversion associated with great mobility, the absence of sensitiveness to touch, the elasticity when compressed, the almost circular outline of a transverse section of the body of the uterus (produced by hypertrophy and bulging of the anterior wall), with an absence of any noticeable irregularity of contour, are characters which almost certainly prove pregnancy.

On referring back to the *changes* in the *cervix*, *vagina*, and *vulva*, described in §§ 68—71, the reader will see that they must yield very reliable signs; scarcely any other than the pregnant condition brings with it so persistent and widespread a softening and serous infiltration, such a characteristic formation of folds due to hypertrophy, such an altered position of the vaginal fornix in reference to the portio vaginalis. It is true that these signs are only fully developed in the later months of gestation, but the careful and somewhat practised observer as a rule discovers them very early. I attach great weight to the *dark venous coloration of the mucous membrane of the genital canal*, and to the small bluish varicose knots of the vulva; they have rarely deceived me.

Equal in value with these signs, is the *uterine souffle*. It depends, as we know, on the peculiar development of the vessels of the uterus during pregnancy, and there are but few pathological conditions (intra-mural myomata, large hæmatometra) in which a similar development of vessels occurs. These latter conditions are generally recognisable by their special symptoms, and if such symptoms are absent, the souffle settles the question of pregnancy. Especially is this true of the first months, for an enlarged diseased uterus of the size that belongs to early pregnancy, scarcely ever yields the souffle, since when so moderate an enlargement is due to disease, it is not associated with a sufficient vascular hypertrophy to cause a souffle.

Among the remaining signs mentioned above, I regard the *hypertrophy of the abdominal walls* as decisive under certain circumstances, and also the possibility of raising those walls up in thick folds, in spite of the increased abdominal distention; the same is true of the ease (resulting from the hypertrophy) with which the now smooth and flaccid *umbilicus* can be drawn in any direction. Amongst the *changes in the mammæ*, the succulence and swelling of the areola, the great irritability and contractility (due to muscular hypertrophy) of the latter and of the nipple are of especial importance; also the extension of the areolar pigmentation in a peripheral direction, shown by the appearance of the secondary areola; and finally the facility with which a thin serous and even a milky fluid can be squeezed out of the nipple.

I must not forget to mention that the raised temperature of the uterus, as compared to that of the vagina, may be a useful sign of pregnancy.

§ 130. These various considerations show that, although absolutely reliable signs are only present during the second half of pregnancy, the "grounds of probability" allow a tolerably safe opinion to be given in the first half, and often very early in it. Some signs of course are more to be depended on than others, and individually their value is less than when several co-exist; but when all agree with each other and with the usual progress of gestation, the existence of the latter is placed beyond doubt; as early as the second month it may be possible with their help to answer the questions which present themselves.

Nevertheless, as has been pointed out in the introduction to this chapter, under some circumstances the diagnosis whether pregnancy is present or not may be extraordinarily difficult; either on account of irregularities in its progress, or of unusual complications, or of pathological conditions simulating some of the symptoms of pregnancy.

It is impossible here to describe in detail the differential diagnosis of abdominal tumours in reference to pregnancy; the general rules to be followed in such cases are contained in the above description. The first question should always be whether any existing enlargement of the abdomen is due to that of the uterus, and evidence of this should first of all be sought. Should satisfactory evidence that it is, be forthcoming, the

want of knowledge, than to want of care and to a superf
examination.

(2) *The Diagnosis of the Period of Pregnancy,—the Calcul* *of the Date of Delivery.*

§ 131. The diagnosis as to how far a woman is advanc
pregnancy, and when the proper time for her delivery will ar
is even more difficult than the diagnosis whether she is preg
or not. This difficulty in coming to an accurate concl
depends partly, as already explained in § 62, on our igno
of when pregnancy begins, partly on the fact that it appear
to have any definite duration, but to vary within certain li
For calculating its duration in an individual case, we may
the following fixed points :—

a. The day of the fruitful coitus.—This datum is but r
available, since very few persons can accurately fix the time
is only useful in those rare cases in which a single coitus
place ; and now and then when trustworthy women, espe
such as have already borne children, know by peculiar sens
during or soon after coitus that they have conceived ; too
reliance however must not be placed on such sensations.
under these circumstances that we obtain the most acc
information as to the period that pregnancy has reached
the date of the labour may be fixed at the 272nd to 275t
after coitus.

view (which took 280 days as the normal duration), and gele's method of calculation (that from the first day of the menstruation 9 months and 7 days should be counted, in er to find the date of delivery) are found correct. It is how- r only the average duration which is thus fixed, and in practice roves true in but few cases; errors to the extent of a fortnight met with on both sides, indeed yet greater ones may, for the sons given above (§ 62), occur in individual cases. It is pro- ly safer when the information can be obtained, to base the ulation on the interval between the onset of the last menstrua- but one to the onset of the last of all, and to estimate duration of gestation in that individual at 10 times that rval.

. *The period when fœtal movements are first perceived.*— s as a rule occurs between the 18th and 19th week, *i.e.* a e before the middle of pregnancy; primiparæ perceive the ements somewhat (on an average one week, Ahlfeld) later. s very unsafe to calculate the date of labour from this as a d point, since the date of such movements varies greatly, depends not only on the sensitiveness and attention of the gnant woman, but also on the quantity of liquor amnii which resent.

132. *d. The degree to which the changes in the uterus have anced.*—Of course only those changes can be used for cal- ting the period of pregnancy, which progress regularly on to end, viz. the increase in size, especially in a longitudinal ction; for it will be clear from § 68 *et seq.*, that the changes especially the shortening of, the portio vaginalis, cannot serve basis for our estimation (the shortening of the cervix merely icates that contractions are taking place).

rom the second month onwards, the uterus gradually ends, and moves forwards. It reaches nearly to the navel he middle of pregnancy, while by the 28th week its upper projects a hand-breadth above it, reaching its highest nt in the 36th week; during the last weeks it sinks a little a result of the fixing pains, which force the presenting t into the pelvic inlet. In order accurately to determine the *ht of the fundus*, its margin must first be ascertained by ussion, and the length of the line connecting its highest t with the upper edge of the symphysis measured. The

navel cannot be used as a fixed point, since its distance fr
symphysis varies greatly in pregnant, and indeed in all w
Hecker found a variation of 13—31 cm. (5—12 in.), I
of 13—28 (5—11 in.). The average elevation of the
according to my measurements, amounts in the 22nd
week to 24—24·5 cm. (9·4—9·6 in.; in the 28th to 2
(10·5 in.); in the 30th to 28·4 cm. (11 in.); in the 32nd—
29·5—30 cm. (11·5—11·75 in.); in the 34th to 31 cm. (12
in the 35th to 31·8 cm. (12·5 in.); in the 36th to 32 cm. (1
in the 37th to 32·8 cm. (12·8 in.); in the 38th to 3
(12·9 in.); in the 39th—40th to 33·7 cm. (13·25 in.).

Thus a gradual increase takes place, which is shown
the series of minimum figures for each week. These m
ments however cannot be utilised for an exact calcula
any individual case, since the variations for each period
considerable; they can at best only justify an appr
conclusion.

In addition to the height to which the uterus has rise
abdominal cavity, the greatest *circumference of the*
may be employed for calculating the period of pregnancy,
is mainly dependent upon the extent of the uterine enlar
It is however only a rough method, for although the
as well as the maximum and minimum, increase with the
weeks, this increase after the 28th week is but trifling,
maximum and minimum figures for the different epochs
differ to any great extent. Thus in the measurements
made, the circumference varied :—

In 21	persons at the	28th	week from	78—101 cm.,	averaging	90
„ 43	„	32nd	„	81—110 cm.,	„	91
„ 50	„	35th	„	84—109 cm.,	„	96
„ 61	„	38th	„	85—108 cm.,	„	94
„ 73	„	39th—40th	„	85—107 cm.,	„	94

The errors which arise when the period of pregnanc
culated from the height of the uterus, or the circumfe
the abdomen, depend on the fact that each of those facto
at the some period of pregnancy: the elevation depend
full or empty state of the rectum and bladder, on the p
the woman (whether erect or horizontal), on the more
marked protrusion of the lower segment of the uterus
pelvis, and on the variable quantity of liquor amnii; the

nce of the abdomen depends on the same causes, and further the varying thickness of the abdominal walls and on the ction of the intestines.

133. *e.* The best basis for our computation is the *size of the us;* for this increases with each month, and the variations in erent individuals cannot from the nature of the case be very t at corresponding periods. The practised observer can by pation form an approximately correct opinion of the size of fœtus, and from it determine the period of pregnancy with a amount of accuracy. But it is still better to measure the *gth of the fœtus*, and to determine its age from a comparison the result with the size at the different months, as given in 101 and 102. By applying the arms of a pair of callipers to lowest portion of the head, and to the highest portion of the ech (the two poles of the ovoid fœtal mass), or *vice versa*, length of the fœtal axis is obtained, and this appears to ount to about half the length of the whole child. In taking measurement, it will of course often be necessary to introduce arm of the callipers into the vagina, in order to reach the of the lowest pole.

Every one of these methods however only yields approximately rect results, so that errors of 1 to 3 weeks are by no means ommon. Especially during the first half of pregnancy, is the ult obtained by the examination very unreliable, and the ulation based on the statements of the woman is the more stworthy; during the second half, the physical signs, if duly ghed, form a fairly good guide for the skilled practitioner, here also the tyro should rely most on the time-honoured ulation of Nægele. The actual onset of labour must never fixed for a certain day; a margin of at least 7 to 14 days uld be allowed; otherwise the practitioner will incur ridicule, do harm.

134. I may take this opportunity of mentioning that the calculation may be falsified, by the duration of *pregnancy g protracted* considerably beyond its normal duration (as ady stated in § 62), and labour come on much later,—*deferred ur.*

he extreme protraction in such cases amounts to 4 weeks or tle more, beyond the usual 280 days, these being cases in ch the calculation was founded on the date of the last menstruation[1]. That such observations on the degre protraction, cannot allow of any final opinion being arriv obvious from the varying relation of menstruation to th fruitful insemination. It is therefore interesting to not the cases of deferred parturition, in which the day of the coitus was accurately known, the postponement was a r short one; the latest authentic date of birth in such a ca the 293rd day (Skey). In the observations bearing point, the children were always unusually well develo this must be looked upon as a criterion of the protract nancy. The cause of the protraction is unknown, but is to be ascribed to the menstrual interval in the individ cerned (*cf.* § 62) being a long one; accordingly the pr sometimes recurs in the same woman, is therefore habit

(3) *The Diagnosis between a First and a Subsequent Pr*

§ 135. It may under some circumstances, and especi a forensic point of view, be of great importance to d means of physical signs, whether a pregnant woman ha borne children or not. Usually it is possible to ar decision, inasmuch as pregnancy and labour genera indelible traces behind, which form characteristic r distinction.

In the case of *primiparæ*, the physical signs are mai described above. The breasts are full and tense, distin minent and sensitive to pressure. The abdominal wal smooth and stretched, especially at the sides of the trium, and palpation is for that reason more difficult; is true of the uterus, while in addition it may readily be to contract. Striæ occur only in the later months, s necessary stretching of the deeper layers of the skin take place till then; they are reddish, reddish-white coloured, and have a "fresh" look. The labia are in the frænulum is uninjured, either at its cutaneous or urface; the vaginal orifice is relatively narrow and contractile, nd each portion of the torn hymen remains as a continuous ringe. The vaginal rugæ are crowded together, the walls and specially the fornix, are not loose and flabby as in multiparæ, at most does the distinctly hypertrophied urethral thickening project into the vaginal entrance. The portio vaginalis is slender, smooth and very soft; the external os forms a round small opening with smooth borders and a sharp inner edge, where the cervical mucous membrane begins; at the end of pregnancy, when the presenting part is forcing down the anterior portion f the vaginal fornix, the anterior wall of the portio vaginalis ppears very short.

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[1] W. Duncan (*Med. Times*, 1877, ii., p. 712) records a case in which t reckoned from the cessation of menstruation, amounted to 325 days.

[2] *Cf.* the interesting observations on the different factors which influen tion of pregnancy in our domestic animals, by Franck, *Thierärztliche G* pp. 141—146.

§ 136. In *women* on the other hand *who have borne children*, races are found of the former enlargement of the breasts and bdominal integuments, and of the passage of the child through e parturient canal. Moreover the breasts are flaccid and pen- ulous, the nipple enlarged and withered. The abdominal walls e flabby, often look withered and discoloured, can easily be ised into folds, and sometimes the skin hangs down pouchlike, pecially over the pubis. In addition to those recently formed, d faded wrinkled and puckered striæ are seen, as early as the rst months, not differing in colour from the neighbouring skin. he uterus is more easily palpated, and often hangs over in ont. The flaccid labia gape. The frænulum is often absent, lthough not invariably so; in the former case it is replaced by icatricial tissue, in the latter, *i.e.* when it is more or less pre- erved, some cicatricial tissue is found on its mucous aspect; ot uncommonly also a cicatrised perinæal tear may be found. f the hymen large or small taglike remnants are found with lubbed ends (carunculæ myrtiformes), the continuity of the ringe having been destroyed. The vaginal introitus and canal re wide, the mucous membrane smooth, without columnæ ugarum, the vaginal walls project as great folds into the lumen f the canal; the anterior vaginal fornix is especially apt appear as a deep loose pouch. The cervix, *i.e.* the portio aginalis, is plump and irregular; at the sides of the external os, specially on the left, are deep grooves and even fissures, as if ortions of the lips were missing. This sign is only met with fter parturition, and must be distinguished from rents and gaps roduced by operative measures unconnected with labour, and from cicatrised ulcers; it may therefore be regarded as a certain sign of a previous confinement. ("Quæ quidem cicatrices signum indubitatum præbent partus jam editi,"—Rœderer.) Owing to these so-called "cicatrices" and gaps, the os is patulous, *i.e.* it allows the finger to penetrate more or less deeply into the cervical canal, which latter resembles a funnel contracted above. The internal os also is often freely patulous for weeks before parturition, but as the rule the cervix only begins to shorten with the onset of labour pains.

These signs (and amongst them the absence or cicatricial condition of the frænulum, the destruction of the line of attachment of the hymen, above all an old perinæal rent and the cicatrices of the os are almost pathognomonic), when present, point clearly to a previous labour having taken place; but their absence does not disprove such an event. For the flaccidity of the breasts and abdominal walls, as well as old striæ may be absent, even after a labour at the full time; the frænulum and the line of hymeneal attachment, indeed even the entire hymen (with the exception of small fissures, which are met with even in multiparæ) may be preserved, the os uteri may seem to have a smooth edge, and the deeper fissures at the points where the lips are connected with each other, may be missing. All the more so after an abortion or premature labour. And in cases where a number of years have elapsed since a single confinement occurred, traces which were distinct at the time may some of them have disappeared, others have become so indistinct, as to be no longer of value.

(4) *The Diagnosis between a Living and a Dead Fœtus.*

§ 137. We obtain proof that the fœtus is alive by recognising phenomena which only a living organism can present, *e.g.*, by discovering movements of fœtal parts, and hearing the fœtal heart-beat. Conversely, an absence of these phenomena, when established by a repeated careful examination, is evidence of the death of the fœtus. The latter conclusion however is not reliable in those rare pathological cases in which a super-abundant quantity of liquor amnii makes it impossible to feel the parts, and to hear the heart of the fœtus, nor does it hold good ring the first 18 weeks, since during that period those manitations of life lie beyond our power of detection.

In such cases we are justified in assuming that the fœtus is ive, when no special injurious influences have been at work at might lead to its death, when the signs and symptoms of regnancy have followed their regular course, and when the regnant woman is in good health. The following conditions nd appearances on the other hand indicate with more or less robability that the fœtus has perished : diseases in the mother hich, as a matter of experience, are often followed by intraterine death (syphilis) ; the operation of influences which are nown to have the same effect (external violence, drugs, *e.g.* reparations of lead, strong emotional excitement) ; the cessaion of the fœtal movements, which had previously been distinctly elt by the mother ; the appearance in her of morbid sensations nd symptoms, viz. shivering, lassitude, dyspepsia, a sallow ale look, a sense of chilliness and weight in the abdomen, as if contained a foreign body ; the arrest of the objective signs of regnancy which till then had progressed regularly, and in nsequence of which arrest the uterus sinks before its usual me, diminishes in size (by absorption of liquor amnii) and ecomes soft, while an abundant serous or sanguineous discharge kes place, and the breasts, after a sudden but temporary crease of fullness, collapse, become flaccid, and allow milk to ude.

Moreover if the temperature of the uterus, which owing to the oper heat of the living fœtus, should be somewhat higher than at of the vagina and axilla, falls to or below the latter, such l is an indication of the death of the fœtus ; but this sign is ficult to use in practice.

When the internal os uteri is patulous, it is sometimes possible feel the cranial bones to be loose and movable, a sure sign at the fœtus is dead.

To the questions which have been answered in the previous sections, there is quently added in practice, one relating to the *sex of the expected child*, but smuch as the causes influencing the development of sex have as yet been little elucidated, it cannot be answered with any degree of assurance. An nion founded upon the greater frequency of the fœtal pulse usually met h in girls (§ 119), is of no value, since the average numbers are so nearly e, and the limits in one sex so greatly overlap those of the other. Nor can more reliance be placed in the other methods of diagnosis, such as the increased extent and intensity of the cutaneous pigmentary deposits (so much insisted on by some authors), which are said to occur when the fœtus is of the female sex (Hohl). Of more value would be the size, hardness and firmness of the cranium, characters which are more marked in boys than in girls, could we determine those characters before birth, and did we not here also meet with such numerous exceptions. The serious accoucheur will not attempt to answer the above question.

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SECTION IV.

THE HYGIENE OF PREGNANCY.

§ 138. Since pregnancy is a physiological condition, it might
pear unnecessary to speak of its hygiene. But this period of
e months is distinguished by such active and far-reaching
nges in the organism, changes which are of the most radical
ure and may rapidly transgress the normal limits, that new
blems have to be dealt with. Moreover these changes may
accompanied by numerous disorders, and external influences
y easily interfere with their natural progress and indirectly
ct other organs; again the various disorders not only have
nediate consequences, but reach into the future and involve
fœtus also, so that every ailment causes a double anxiety.
is the province of the physician to enlighten the pregnant
nan in regard to her condition, to encourage her patiently to
r trifling and unavoidable discomforts, which are unaccom-
ied by risk, at the same time to recommend such *régime* as
uited to her condition, and to advise her to avoid anything
ly to do harm.

t is true that in most cases a pregnant woman fares best,
n in her new condition she adheres to the same mode of life
suited her well before. Sometimes however her habits are
very appropriate in view of her altered state, and many
es would suffer, if these were not modified. While the above
ement therefore is perfectly true, yet the physician must
n step in to suggest improvements, and it is by no means
least of his duties to oppose any foolish prejudices. I shall

take it for granted that the principles of a rational gen hygiene are known, and merely make a few special remarks.

§ 139. Since a pregnant woman is very impressionable, liable to be prejudicially affected by excitement, she should a everything that might make a deep and lasting impression u her mind; affecting scenes, exciting shows and books decidedly injurious. Depressing thoughts must be carefully k away, and she must be forbidden to frequent the sick chamb especially should she not be present at a labour, still less difficult one.

On the other hand, the necessity for regular *exercise in open air* is to be firmly insisted on. It is undoubtedly injuri to lie on a sofa all day, after being in bed till near midday; s habits induce sluggish digestion, sleeplessness, and a host psychical disorders. In such cases the physician must inter with decision, and remind his patient of the wife of the labou or the farmer, who continues at hard work up to the time parturition, and as a rule does exceedingly well under it; if this is not sufficient, it is often of use to remind the wom of her duty towards her offspring. The carrying of weigh driving over rough roads, prolonged railway journeys are to forbidden, also dancing after the fourth month and attenda at any parties which interfere with sleep; in these cases h ever habit is of much importance, and allows many an excepti

The *mode of dress* depends on habit and constitution; it m not be tight, but keep the body at a uniform warm temperatu especially the lower portion. Corsets are to be entirely discard also garters (especially such as are worn below the knees), si they encourage or directly provoke the development of œd and varices of the legs. Women with flaccid abdominal w or with a movable or a pendulous uterus, must wear an abdomi bandage for support, and they can best cut it out themselve fit their figure; it matters little of what material it is ma Such women also during the last weeks of pregnancy sho allow themselves to be examined in reference to the lie of fœtus.

The medical man is often questioned as to the advisability permissibility of hot or cold *baths*, and his advice should guided by the previous habits of the pregnant woman, whil course any excess is to be discountenanced, especially during first months. Women who are not in the habit of taking a bath regularly, should only be allowed tepid baths at 25°—34° C. (77°—93° F.) once a week, and only in the last 6 weeks somewhat more frequently. It is absolutely necessary that the external genitals be kept perfectly clean by the use of tepid water, bearing in mind the increased secretion and the frequent development of erythemas; vaginal irrigations on the other hand are only to be allowed where there is much vaginal discharge, and even then they must be cautiously carried out and with lukewarm water.

In regard to *food* and *drink*, the pregnant woman may be allowed to do as she likes, so long as excess is avoided especially at supper time and during the last weeks. The so-called longings, when directed to things that are not absolutely injurious, should not be too rigidly opposed. Care must be taken that the *bowels are daily evacuated;* negligence in this respect is well known to be common amongst women, and is always followed by more and more obstinate constipation with its consequent disorders and sequelæ during the lying-in period.

When dietetic measures are not sufficient, mild laxatives may be administered every day, such as preparations of rhubarb, senna, magnesia, &c.; but strong saline purgatives are forbidden, since their frequent use appears to have a decidedly injurious effect on the development, and especially on the formation of the bones of the fœtus. Much harm is done by clysters; their habitual use leads to stretching, relaxation and elongation of the rectum without the desired object being attained, viz. an easy daily emptying of the large intestine; where they are liked and do their work, the large intestines should be filled according to Simon's plan of irrigation as a substitute. A perfectly innocuous remedy for habitual constipation, and one rarely failing to accomplish its end, is afforded by combinations of iron with aloes in small doses (ferri sulph. gr. xlv, ext. aloes gr. xxx; f. pilulæ 30, sum. 1—2 o.m., or one may be taken after each of the three principal meals).

The *breasts*, particularly the nipples, demand special attention; they should be kept warm, supported below by a napkin and protected from any prolonged pressure; excessive sensitiveness of the nipple and its areola may best be blunted, by bathing them with cold water containing some alcohol. Depressed nipples may sometimes be rendered more prominent by pressing back the areola with a wooden or elastic ring or a nipple-shield, but such contrivances are generally useless; the same is true of attempts to drag forward the nipple; this and similar procedures are quackery, and give pain without doing any good.

As regards the permissibility of coitus, man well might follow the example of the lower animals; but with our mode of life, giving such advice is like preaching to stones. I am convinced however that many an early abortion in young women is brought on through sexual excesses, and therefore recommend the greatest possible abstinence for the first 3 or 4 months.

Lastly, it must be mentioned that when the disorders accompanying pregnancy are unusually severe and injurious, something may be done to alleviate the symptoms; care in the use of remedies however is requisite, nor should too great expectations be based upon them.

Therapeutics as a rule can do little for such disorders, and the practitioner will do least injury and therefore do most good to his patient, if he cautiously explains this, and cheers the pregnant woman by holding out the prospect of spontaneous cure by labour.

2. *Parturition.*

§ 140. As soon as pregnancy has reached its natural termina-
n and the fœtus is mature, the latter is expelled together with
appendages from the body of the mother; in other words
turition takes place, and the various organs which had under-
ie alteration gradually return to their non-puerperal condition.
ree factors have to be considered in reference to this process
expulsion: the expelling force, the body which is expelled,
l the canal through which it passes. The expelling force
derived from the contractions of the uterus and of the ab-
ninal muscles, the other two factors forming the obstruction
ich the force has to overcome. The fœtus influences the
cess in virtue of its volume, shape, lie and attitude, as well
of its connection with the mother; the parturient canal in
tue of the closure of the uterus, its own narrow calibre
pecially in the lower section) and the dimensions of the
lvis.

In a normal labour these obstacles are overcome by the
pelling forces, without any injury being done either to mother
fœtus. It is this normal course of events, the modifications
hich occur in special cases, and the phenomena that show
emselves in the uterus and fœtus, that are to form the subject
the following pages.

But two preliminary questions must first of all be discussed:
at is it that determines the onset of the contractions? and
at are the relations of the uterus to the central nervous
tem?

141. The first question, viz. what is *the determining cause*
labour, has been a *quæstio vexata* amongst obstetricians, but
y explanation that has been given (*e.g.* that based upon the
t irritability of the uterus and of its nerve endings at the
nination of pregnancy, that based on the stimulation of the
ix by the growing ovum, or on the loosening of the fœtal
nections, or on the return of the menstrual nisus and conges-
after 10 months), falls short of the mark, and simply brings
back to the point from which we started. The same must be
d of the view that the onset of pains is due to the venous
gorgement of the placenta (leading to excess of carbonic acid

and deficiency of oxygen, the latter being supposed to give rise to the contractions[1]), brought on by the spontaneous thrombosis in the veins at the placental site, which occurs during the last months of pregnancy. In all such explanations the question constantly arises, why does all this take place at a particular time? On the other hand, the phenomena accompanying the birth of twins (which are often born at a considerable interval from each other), the continued growth of one after the expulsion of the other; the onset of contractions of the uterus (or fœtal sac) at the right time (*i.e.* at the time that the fœtus has become mature), in normal as well as in extra-uterine cases; the fact that the extra-uterine fœtus dies when it has become mature (in cases where it has not perished earlier as a result of the mechanical relations of the sac in which it lies), all go to show that the reason why labour occurs at a definite time (which however varies in the case of different species), must be sought for, not in the uterus and its changes, but in the fœtus. It is the maturity of the latter which gives the signal for contractions, and this can only be explained by some substances gradually accumulating in the maternal blood, as maturity approaches and arrives; which substances had till then been used up by the fœtus, but are so less and less, till at a certain point the fœtus can no longer make use of them, since it now requires other substances for its further development[2]. These substances (and we may assume them to be chemical irritants) by means of the blood call the motor centres of the uterus into activity, just as the other automatic movements in the body are called forth as a result of similar chemical irritation of their centres. By the time that these substances have collected in the blood, the anatomical changes in the fœtal appendages have progressed so far, that the separation, so to speak, of the fruit from the tree is easily accomplished.

A *motor centre* for the uterus exists in the *medulla oblongata*, and indeed very near to that portion of it which is occupied by the vaso-motor centre. From this point it extends some distance down the fourth ventricle. The motor nerves run partly in the spinal cord and reach the uterus through the sacral nerves, but the principal portion are spinal fibres, which run in the course of the aortic plexus. This is a plexus derived from the superior mesenteric plexus, and running down along the aorta, whose main fibres (aortic nerves) with the assistance of the branches of the spermatic ganglia which have joined them, and of the lumbar ganglia of the sympathetic cord, form a wide plexus at the bifurcation of the aorta—the great uterine plexus. About 4 cm. (1·5 in.) below the bifurcation, this mass of nerves divides into the two hypogastric plexuses, which after being joined by numerous branches from the lowest lumbar and the upper sacral ganglia of the sympathetic, encircle the rectum, and pass to the upper portion of the vagina and to the uterus. Each hypogastric plexus then divides into a smaller division passing to the posterior and lateral regions of the uterus, and into a larger one, which with the second, third, and fourth sacral nerves forms the *great cervical ganglion*. This in pregnant women is a very broad plexus, which lies on the posterior vaginal fornix, and supplies the whole uterus, especially the cervix.

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[1] *Cf.* Leopold, *Arch. f. Gyn.*, xi., p. 499; Runge, *Z. f. Geb. u. Gyn.*, iv., p. 75.

[2] It is for this reason that the mature extra-uterine fœtus perishes.

It is however very doubtful whether the centre placed in the medulla oblongata, is the only one which controls the activity of the uterus. At most it is merely a reflex centre, in which stimuli coming from the surface and deep regions of the body are modified, and by which the changes in the uterus are brought into harmony with those of other parts of the body, more or less closely connected with it either in virtue of their function or their position. Whether the influence of that centre over the uterus is merely exerted by means of vaso-motor nerves, in other words whether the reflex movements are brought about through changes in the circulation in the generative organs as a result of the stimulation of vaso-motor nerves, or whether that influence passes by special motor tracts, is not settled, and matters little as far as the result is concerned.

On the other hand, both clinical observation and experiment show that the *lumbar spinal cord* contains independent centres for uterine contractions, indeed that it is in this region of the spinal cord that the immediate centres (both reflex and automatic) must lie, and there are also other facts which show that the uterus is to a certain extent *independent of the spinal centres;* it almost seems as if the uterus could not only be thrown into action in response to stimuli actually affecting the nerves in its walls and the ganglia situated there, but as if the activity which has once been set going, were maintained by them. We may take it as settled that the normal sequence of movements is due to the anatomical arrangement of the fibres of the uterus, and not to special nervous co-ordination.

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(1) *The Clinical Progress of Parturition.*

§ 142. For a variable period before the onset of actual labour pains, a series of phenomena show themselves (in rare cases they appear to be entirely absent), which may be called the *premonitory signs* of labour: changes in the shape of the abdomen, increased secretion from the genital canal, and distinctly perceptible uterine contractions. The uterus sinks a little in the abdomen, grows wider, and projects further forwards; the head expands the lower segment of the uterus (especially its anterior half) more than it did before, and enters the pelvic brim; the cervix is pushed further backwards and upwards, and is distinctly shortened. As a result of the œdema (caused by the obstruction to the circulation) of the parturient passages, and probably also of an unusually watery condition and increased quantity of blood, these passages, and especially the cervical mucous membrane, secrete more freely, their surface feels smoother and softer, their wall can be more easily stretched, and the parts about the vulva appear fuller and tenser. The sinking of the uterus causes a feeling of looseness and freedom about the epigastric region, and often a remission of many of the discomforts caused by the pressure at this part of the body; others however soon take their place, for instance pains about the sacrum, difficulty in walking and standing, a more frequent desire to make water, and tenesmus. From time to time contractions of the uterus come on, which the pregnant woman perceives as unpleasant sensations passing from the sacrum to the pubes, as a feeling of tension in the abdomen, and during which a hand laid on the abdomen feels the uterus harden and rise up against the abdominal wall. This premonitory stage may last for a considerable time; now and again it entirely disappears, and in such cases it has been brought on prematurely by external influences; at other times it excites so little attention, that labour seems to begin all at once. But the actual *commencement* is always to be referred to the time during which the uterine contractions have been bringing about a perfectly evident, and never entirely obliterated, dilatation of the os uteri,—of the external os in almost all primiparæ and in some multiparæ, of the internal os in the majority of the latter.

§ 143. The *uterine contractions*, whose mechanism will form the subject of the following section, may be thus described:

The uterus is a muscle composed of unstriped fibres, and is subject to the laws which regulate the movements of such fibres. Its contractions are therefore *involuntary*, they can neither be called forth by the will, nor when once in progress can they be inhibited. As with all unstriped muscles, the contraction is a *peristaltic* one, beginning at the fundus and from there passing to the cervix. But the separate contraction waves follow so rapidly upon each other that soon after the movement begins, the whole organ is in a state of contraction; it hardens and rises up from the subjacent parts, the abdominal wall is pushed forwards, and pain is felt in proportion to the increased hardness. After a short time the tension gradually diminishes and relaxation sets in, beginning at the lower portion; then follows an interval for restoration, a period of diastole, after which the same sequence recommences. Even when the relaxation is not very obvious (as not uncommonly happens in an advanced stage of parturition), if it seems as if some degree of contraction persisted throughout the diastole, this deceptive appearance is almost always due to the thickening of the uterine wall which accompanies the progressive emptying of the uterus.

Uterine contractions are essentially *rhythmical*. This rhythm can be demonstrated to a certain degree in each contraction, inasmuch as the latter does not at once attain its maximum strength; it is feeble at first, increases steadily in strength, remains for a certain time at the climax of intensity, and then gradually subsides and passes into quiescence (phases of incrementum, acme and decrementum). The various phases of this rhythm are however not the same during the whole course of labour. On the contrary, at its commencement the intervals between and the duration of the several pains are approximately equal; but as labour advances and the uterine walls increase in thickness, the intervals grow shorter and shorter, while the force of the individual contractions becomes stronger; the maximum intensity is quickly reached, is maintained for a long time, and then rapidly passes into the period of repose. The duration of the contraction and that of the intermission are therefore usually in inverse proportion, and both the strength and frequency of the former are, when the muscular tissue of the uterus is healthy, as a rule in proportion to the amount of resistance; the physical development of the lying-in woman in other respects has no influence over the pains.

The contractions of the uterus during labour are invariably accompanied by *pain*, and they are therefore in almost all languages spoken of as “pains.” This pain has its seat in the pelvis, in the sacral and lumbar regions, and from there radiates over the abdomen towards the pubes (following the course of the hypogastric nerves) and the thighs. At the commencement of labour, it is an indefinite dull forcing sensation in the pelvis, which becomes more painful as contractions increase in intensity; indeed it often becomes unbearable, and causes the woman to be greatly agitated. The pain is mainly due to the tension and expansion of the lower segment of the uterus (including the cervix), and especially of the edges of the os. Later on, the nerves lying in the uterine muscular tissue are stimulated by the fibres in the several muscular layers gliding over one another, then follows the stretching of the vagina, and finally that of the vulva and perinæum, regions which from above downwards are more and more abundantly supplied by spinal sensory fibres. The pain in the thighs and sacral region is due in part to the alteration in the shape of the uterus during a contraction, in part to the pressure of the fœtus (as it passes through the pelvis) on the nerve trunks and plexuses in the pelvic cavity, in part to the venous engorgement of the sacral portion of the spinal cord and its membranes, and of the surroundings of the sacral nerves at their points of exit; in part also they are of the nature of "sympathetic pains."

A *perfectly painless labour* does not occur under normal conditions; the suffering however may be extremely slight, and may therefore scarcely be noticed. This is especially the case when the preparatory stage has advanced very gradually, and the obstruction to delivery is so very weak that the fœtus can overcome it almost entirely by its own weight, the expelling force rendering it a slight assistance.

§ 144. In addition to the "pains" already described, the *abdominal muscles* form an auxiliary expelling force, which compared with the first however is only of secondary importance. Indeed it may be entirely absent, as is shown by those rare cases in which parturition has occurred in paralysed or deeply narcotised persons, and by cases in which complete procidentia of the uterus &c., was present. This action of the abdominal walls depends upon a combination of respiratory movements. The parturient woman fixes her body by applying her limbs (especially the lower) to some convenient surface, takes a deep inspiration (thus forcing down the diaphragm), and closes her glottis. The abdominal muscles now contract and diminish the size of the abdominal cavity; the expiratory muscles next come into action, and push the already contracted diaphragm yet further down upon the abdominal cavity, with the result that a uniformly distributed pressure is brought to bear on the whole contents of the abdomen, therefore also on the uterus, and forces the latter downwards. The simultaneous compression of the thoracic cavity makes it impossible for the diaphragm to be forced upwards, and so prevents the uterus from being forced back against the vertebral column.

The action of the abdominal muscles, the so-called bearing down, is usually a voluntary act, but at the height of a pain, and especially during the last stages of labour, it is withdrawn from the control of the will, and then becomes purely reflex. Its action as an expulsive force is entirely indirect, inasmuch as it is the uterus which is directly affected, and the fœtus is so only secondarily. Since however the extent to which the uterus can descend on to the pelvic brim is limited, the pressure exerted on the part of the uterus lying above the brim, is transmitted through its wall, and thus comes to act on its contents. This force can of course only act as a propelling agent, when the os uteri no longer offers any obstacle, and it is of most importance in cases of great resistance; it is most useful when its action coincides with the climax of a pain. I must not omit to mention that it is mainly by the action of the abdominal muscles that the detached placenta is expelled.

A certain, and perhaps not unimportant, degree of expelling force is contributed by the *round ligaments* of the uterus. These are direct continuations of the uterine fibres, and contract with the pains. In virtue of their direction (§§ 44 and 72), they must, when they contract, draw the uterus firmly down upon the pelvic brim, and its fundus forwards; and since their fibres are spread out on the uterus, the ligaments must, when contracted, exert a pressure on the surface of the latter which will increase the intra-uterine pressure (Lahs).

No proper expelling action can be ascribed to the *vagina*, it is too greatly stretched by the advancing fœtus; but by its elasticity, and by the contraction of the voluntary muscular fibres surrounding its lowest portion, it may help in expelling small masses, such as the last parts of the child or the placenta.

§ 145. Inasmuch as the blood-vessels in the abdomen are affected by the rise of intra-abdominal pressure accompanying labour, the blood endeavours to escape into channels exposed to less pressure; consequently it flows into the lower portion of the cervix, into the vagina and its neighbourhood. This leads to an increase of the œdema (already mentioned amongst the premonitory signs), to increased infiltration and softening of the parturient canal, and to more abundant secretion from its mucous membrane, all of them physical signs of labour, which are especially marked in the cervix, and which have an important influence in enabling the fœtus to traverse the canal without injuring it.

The pressure in the arterial system increases with each pain; the *frequency of the pulse* rises from its commencement up to the acme, and then, as the pain diminishes, slowly regains its former rate; exceptional cases however are met with in which the pulse appears not to alter. The *body temperature* also increases a little with each pain, and indeed rises gradually as labour progresses, though as a rule only to an unimportant extent; its variations are greater than under normal conditions. The temperature of the uterus is slightly raised during a pain, a fact which is easily intelligible from a consideration of the severe work done by this muscle. The *frequency of respiration* is diminished during the pains, owing to the suffering associated with them and to the use of the abdominal muscles, but during the intermissions and during labour as a whole it is increased, in consequence of the muscular exertion and the increased production of heat. The *secretion of urine* is increased, owing to the raised arterial pressure and to nervous excitement, the urine being at first less, afterwards more concentrated than normal; especially is the amount of sodium chloride increased.

The nervous excitement is often extraordinary, and due mainly to the suffering which has been endured, and the prospect of that which is yet to come. The great muscular activity calls forth general perspiration. Vomiting during the course of labour is by no means uncommon.

We have already spoken in § 119 of the behaviour of the fœtal pulse during the pains; the other changes which show themselves in the child during labour, will be described further on.

§ 146. The progress of labour may be divided into two sharply defined stages, corresponding to the work which the forces of labour have to do, these stages being called the *periods of labour*. During the first, the cervix undergoes dilatation, and the parturient canal lying below it is brought into a condition to allow the child to pass through it (period of dilatation); during the second (period of expulsion), the child, and afterwards the placenta with the fœtal membranes, are expelled.

1. The *period of dilatation* follows immediately on the preparatory period described in § 142; it begins as soon as the os and the cervix dilate under the influence of the pains, and terminates with the complete transformation of the cervix into a wide cylindrical canal. If the cervix (at the commencement of this period) is not yet entirely obliterated, as is so common in multiparæ, it soon becomes so by the advancing ovum, its canal being no longer marked off from the uterine cavity, but forming part of it; in these cases however it is often possible for a long time to feel the anatomical internal os grow tense during the

pains. The head is usually by this time entirely and firmly fixed in the pelvic brim, or is so at any rate during the pains. The latter gradually increase in force and frequency, cause more and more suffering, affect the whole system of the parturient woman, and compel her to seek for support. During these pains, the edge of the external os can be felt to be tense, and the fœtal membranes are pushed through it by the liquor amnii in the form of a smooth, convex, tense bladder, "the bag of membranes presents"; when the pain ceases, the edges of the os and the bag of membranes again relax, the latter recedes somewhat, and the presenting fœtal part which, while the pain lasted, could probably not be felt owing to the tense condition of the bag of membranes, can now again be reached. Each pain dilates the os uteri a little more, the bag of membranes can be felt over a larger area, and is driven further through the os; when there is much liquor amnii between the lower segment of the membranes and the presenting part of the fœtus, and when the membranes are very extensible, they may project into the vagina in the form of a cylindrical or sausage-shaped pouch. Meanwhile the parturient canal becomes more and more infiltrated, the secretions from it increase, much mucus is discharged, and there is often some blood mixed with it. This discharge constitutes the so-called "show," and is caused by minute tears in the sharp edge of the os, and by a separation of the decidual layers in the vicinity of the lower pole of the ovum resulting from the protrusion of the membranes. More abundant losses of blood are due to the detachment of the lower end[1] of the placenta (serotina). When the os has attained a certain width (about 8 cm. = 3 in.), the protruding part of the bag of membranes remains tense, even in the intermissions between the pains; it is now on the point of bursting. One of the next pains, a strong effort at bearing down, or any sudden exertion may actually cause the rupture; the liquor amnii in it (*fore-waters*) is discharged, the remainder being held back by the close contact of the presenting part of the fœtus with the walls of the cervix. If however there is not this all round close contact, the whole of the liquor amnii, or at any rate the greatest part of it, may be discharged when the membranes burst; but as a rule some of the liquor which was left behind in cases in which the membranes burst as first described, is expelled with each subsequent pain. When the liquor amnii has been discharged, the cervix uteri is more and more stretched by the large fœtal part which is advancing; at last it becomes so wide, that its wall is in close contact with the sides of the pelvis, and appears to be a direct continuation of the vaginal wall, the latter being merely indicated by the margin of the os uteri which projects a very little beyond it. During the whole of this period the fœtal movements may be distinctly perceived, both objectively and subjectively.

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[1] *Cf.* Küstner in *Arch. f. Gyn.*, xiii., p. 433.

§ 147. *Various Modes of Rupture of the Membranes.*—The membranes not infrequently rupture at a much earlier period than that mentioned above, especially in primiparæ; but so long as it does not happen at the beginning of labour, and is unaccompanied by other anomalies, no evil results as a rule follow. In such cases the membranes usually give way unnoticed, and the discharge of the liquor amnii occurs almost imperceptibly. At other times the membranes do not burst, although the os is fully dilated; they reach down to and even beyond the vulva (*prolapse of the bag of membranes*), and only give way, when or even after the presenting part of the child has passed through the latter. If the bag of membranes gives way not at its lowest portion, but further up near the neck of the child, the presenting head is born covered with the detached piece of membrane (*caul*). In rare cases the whole fœtus has been expelled without the membranes being ruptured, but only when it is small, and the quantity of liquor amnii less than usual.

The rupture as a rule occurs at that part of the bag of membranes which lies lowest in the os, but when the latter is fully dilated, and the presenting part of the child is fixed in the brim, the rupture is apt to occur at the anterior border between the head and the symphysis. Occasionally moreover a part of the membranes lying above the cervix gives way first; only a portion of the liquor amnii is then discharged, and the bag of membranes persists, although it is less tense than before; the torn portion may be again closed up by the body of the fœtus pressing on the wall of the uterus, the bag of membranes may once more become tense, and a fresh rupture take place within the os. A *discharge of "waters" is possible without destruction of the bag of membranes,* in cases where two concentric membranous bags are formed by an accumulation of amnio-chorionic fluid (§ 91), and the tear merely involves the chorion[1]; and lastly, by some fluid, which has been secreted by the decidua, collecting between the ovum and the uterus (*spurious liquor amnii*), and being discharged during a pain.

§ 148. 2. The *period of expulsion* begins when the external os is fully dilated, or at any rate has lost all power of resistance, and ends with the complete birth of the ovum.

After the rupture of the membranes, a short interval of repose usually sets in, during which the wall of the uterus adapts itself to the altered relations. But before long fresh pains come on, stronger and more frequent than those of the first period, and propulsive in their action. These force the presenting part further into the dilated and unresisting os, in consequence of which its edges are pushed or drawn apart and upwards, "become retracted," and before long these edges encircle the head along its greatest circumference (period of crowning). Owing to the pressure of the sides of the lower segment of the uterus, and later on of the pelvis, the skin of the scalp is thrown into folds, and becomes highly œdematous; sometimes even blood is effused above and beneath the periosteum; the swelling thus formed is called the "*caput succedaneum*." The advance of the fœtus now becomes unmistakable, especially during the pains, although during the intermission the head may still recede a little. The deeper it advances, the stronger grow the pains, until at last they compel the woman constantly to bear down; the surface of the abdomen grows very sensitive; the woman is intensely excited, and perspiration everywhere covers her body. The fœtal movements are scarcely ever felt during this period.

When the presenting part reaches the pelvic outlet, it stretches and pushes down the floor of the pelvis, giving rise to a sensation of tenesmus, and expressing the contents of the rectum. The levator ani and the muscles beneath it are elongated; the coccyx is pushed back (*cf.* § 18), the anal aperture forwards; the perinæum, especially its posterior portion, bulges like the segment of a sphere; the labia majora are slightly separated, and the presenting part becomes visible between them; it has reached the genital fissure.

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[1] In a case of labour with a contracted pelvis, I ruptured a thin-walled sac which projected far into the vagina; fully 150 grm. (ca. 5·5 oz.) of thin sticky fluid flowed off; but at the pelvic inlet there still lay the true bag of membranes, with a very thick resisting layer of amnion.

Meanwhile the pains are increasing in frequency and force (*Schüttelwehen, dolores conquassantes*), and cause more and more suffering; the fœtus presses strongly on the perinæum, the labia diverge further and further during the pains, while a continually increasing fœtal surface occupies the pubic fissure; and even though the head recedes somewhat during the intervals, it is not long before a portion remains constantly visible, till finally the greatest or almost the greatest circumference of the presenting part occupies the fissure, even during the intervals; the fœtal part is now at the point of exit. The perinæum bulges more than ever, and is so thinned, even in its anterior half, that the cranial bones may often be felt through it; the pubic fissure looks forwards and upwards; the anus is patulous and oval in shape, the mucous membrane of the anterior rectal wall being visible; the urethral thickening of the anterior vaginal wall is pushed forwards beneath the symphysis as a thick œdematous swelling, the nymphæ and labia majora are pushed on each side, but the former are not entirely smoothed away. Slowly or suddenly under the influence of the abdominal pressure, the anterior and thinnest portion of the perinæum begins to retract over the head (as soon as the parietal eminences have got through), and the latter is completely delivered, the frænulum, as well as a small portion of the skin of the perinæum, or at least its mucous layer, being at the same time destroyed. At this last moment, the woman testifies to the most acute suffering. If the period during which the head is passing through the pubic fissure is prolonged, a *second caput succedaneum* may form on the surface which presents at the fissure.

A short period of comparative repose follows the birth of the head. But it is not long before fresh pains set in, and these, materially assisted by the abdominal muscles, expel the body of the child. At the same time any liquor amnii which remained in the uterus (*retained liquor amnii*), is discharged, mixed with the blood which had been effused during the detachment of the placenta; a good deal of blood moreover is often lost during the delivery of the head.

§ 149. The interval between the birth of the child and the expulsion of the placenta with the umbilical cord and fœtal membranes (the after-birth), is generally spoken of as a separate third stage (*period of the after-birth*); this is not logical, but the expression may be used, provided it is borne in mind that there is no essential difference between the expulsive and after-birth stages.

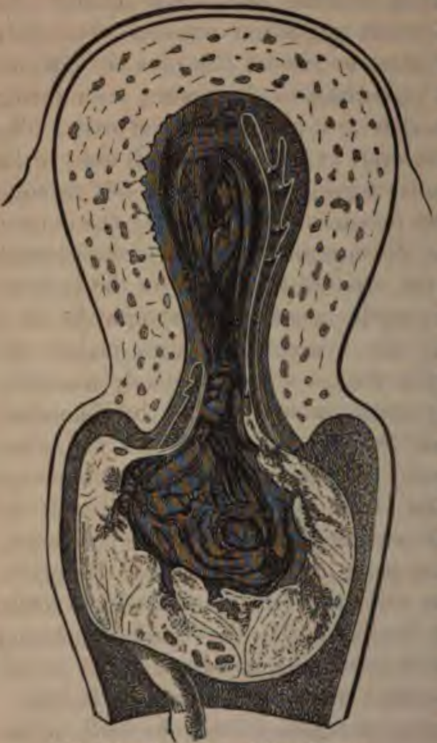

Fig. 42.—Expulsion of the placenta. (According to Schultze.)

After the expulsion of the child, the parturient woman is exhausted, frequently on the verge of fainting; in most cases an attack of shivering sets in, often indeed an actual rigor (1 : 3), caused by the rapid emptying of the uterus and abdominal cavity, and the consequent stimulation of the vaso-motor centre (the same occasionally happens after tapping in ascites, or after a sudden diarrhœic evacuation), by the cooling of the body, and especially by the sudden loss of a source of heat which the parturient woman experiences, when the child is expelled. In order to make good this sudden disturbance of the equilibrium between heat production and expenditure, the regulating centre makes use, as we know, of rigors. Most women however soon experience the pleasant sense of repose, which follows on the performance of hard work. This repose lasts from a few minutes to a quarter of an hour, when fresh pains come on, which entirely detach the placenta and drive it into the vagina—"after-birth pains." The uterus may still be felt to reach high up into the abdomen, and during the "pain" has often an irregular nodular shape. The genital fissure is patulous; its sides are bruised

ery sensitive to contact; fluid and clotted blood is expelled
ervals. The vagina is wide; the cervix uteri and the lower
ae segment are flaccid, their walls having collapsed and
sting apparently of loose flaps covered with blood. Higher
es the contracted body of the uterus, and in its (by this
comparatively narrow) obstetrical internal os may be felt
dge of the partly or wholly detached placenta. The detach-
of the latter began
t the end of the ex-
ve period, and is
completed by a con-
ion of the area of
ntal insertion (in
h contraction the pla-
itself cannot share),
by a displacement of
lacenta by the pains.
line of separation
through the decidual
ullary layer, of which a
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e separated placenta.
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l blood-vessels pass-
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ssarily be opened,
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ever the vessels be-
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hem[1], checks further hæmorrhage. Fresh pains (during

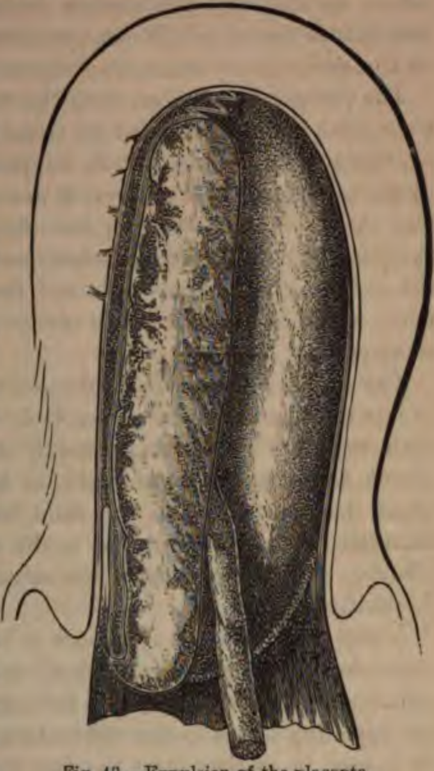

Fig. 43.—Expulsion of the placenta. (According to Matthews Duncan.)

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his thrombosis of the uterine vessels at the "placental area" begins in a great
places towards the end of pregnancy (Friedländer, Leopold). At the time of
rition, the thrombi are far advanced towards organisation, and consist of large
(similar to the decidual cells) derived from the vascular endothelium; just as
tter, by the inequality of the walls of the blood-vessel caused by its proliferation,
to thrombosis, so do those large cells finally bring about the organisation of the
bus (*cf. inter alios* Patenko in *Arch. f. Gyn.*, xiv., p. 422).

which the attached umbilical cord, when ligatured or not yet severed from the child, again becomes tense owing to the placenta being squeezed) now force the placenta into the vagina, or at least into the cervix, not with the fœtal surface first, as is usually represented (fig. 42), but edgewise, the mass being folded towards the uterine or fœtal surface, and rolled together, and the lower edge emerging first (fig. 43). When the placenta makes its exit with the smooth surface first, that is with the membranes turned inside out, premature traction has been made on the cord, or very strong expression used.

The placenta is expelled from the vagina and the vulva by the abdominal muscles, assisted by those in the floor of the pelvis, *i.e.* when it is not, as usually happens, expressed or extracted by the attendant. Its removal is generally followed by a further loss of blood. The uterus now forms a much smaller hard spherical or flattened (from before backwards) mass, lying above the pubes; the vaginal walls are thrown into thick irregular folds, which fill up the pelvic cavity. The post-partum period commences.

The *weight which a pregnant woman loses* by delivery, amounts to nearly the ninth part of her body-weight at the end of the 10th month. This loss is mainly due to the expelled ovum (fœtus, liquor amnii, after-birth), in a less degree to the blood which has been lost, to the fluid which has been evaporated from her lungs and skin, and to the excreta discharged during labour. Primiparæ usually lose somewhat less in weight than do multiparæ.

§ 150. The *duration of labour* is subject to many variations, even when its progress is perfectly natural. They depend on a number of circumstances, and not merely upon the relation of the expelling forces to the obstruction that has to be overcome, as indeed is evident from the fact that it is especially during the first period of labour that the greatest variations occur. Generally speaking, labour lasts longer in *primi-* than in *multiparæ*, for reasons which are sufficiently obvious; in the former it averages ca. 20, in the latter ca. 12 hours (in 506 labours I found the figures to be 17 and 10¾ hours); the statistics that are not uncommonly quoted, as showing a shorter average duration, are due to the difficulty of exactly fixing the commencement of labour.

Elderly primiparæ (*i.e.* those aged thirty years and over) show a somewhat longer duration than the average which has been given. Hecker however, and his results are fairly similar to those of Winckel (Reports, Vol. II. 229—242, III. 185—188), found an average duration of only 21·1 hours; Ahlfeld on the contrary, in 87 persons aged 32 years and over, found the duration to be 27·6 hours. The protraction is mainly caused by the length of the second stage, and is especially to be ascribed to the unyielding character of the lower half of the parturient canal (*i.e.* of its soft parts), and to the consequent diminishing force, or to some other anomaly in the action of the pains. The difference in the *development of the fœtus* as affected by its sex, has a slight influence on the total duration, but it is not noticed till the period of expulsion, and then operates somewhat unfavourably in the case of boys.

In regard to the *duration of the separate stages*, the period of dilatation is on an average 7 to 8 times as long as that of expulsion; the latter occupies in primiparæ about two, in multiparæ one hour; it may terminate very rapidly with a couple of pains, or be prolonged beyond the time mentioned. The natural duration of the after-birth stage is almost always shortened by artificial interference. As a rule the *second stage* passes off the more quickly, supposing the conditions to be otherwise normal, the longer the premonitory and dilatation stages have lasted. Its duration is of importance as regards the prognosis for the fœtus; the longer it lasts, the higher as a rule is the percentage both of apparently dead and of dead fœtuses, as well as of those dying after birth. It has been already stated that the duration of labour in the case of males is generally greater than with females; but even when the duration is the same, the male sex runs more risk throughout, than does the female.

Labour usually *begins* in the evening hours, and most frequently between 9 and 12 P.M.; in the majority of cases it *terminates* during the night (1·19 labours take place between 9 P.M. and 9 A.M. to every 1 occurring during the other half of the day), the maximum frequency occurring in the morning hours from 12—3 A.M.

Easy labours terminate more rapidly, the nearer their time of commencement is to the hours of 3—6 A.M., and 3—6 P.M.

Lastly, a greater number of labours terminate rapidly during the summer than during the winter (100 : 107; in primiparæ 100 : 119, in multiparæ 100 : 103).

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(2) *The Mechanism of Labour.*

§ 151. By the mechanism of labour is meant the mode in which the ovum is expelled from the uterus and parturient canal. Its description therefore includes an account of the operation of the expulsive forces on the contents of the uterus, and the manner in which they bring about the dilatation of the cervix, give rise to the bag of membranes, and cause the advance of the fœtus and the formation of the perinæal canal. The general description, in which the fœtus is assumed to be in the "cephalic lie," will be followed by a special account of the mechanism in the different kinds of lie and position.

a. The Mechanism in General.

§ 152. Though a uterine contraction is fundamentally a form of peristalsis, yet soon after the beginning of a pain the entire body of the uterus is in a state of contraction. Both the shape and the position of the organ are altered in consequence. When the whole of the walls of a hollow muscle contract, the shape of such a sac must approximate to that of a sphere, since it is in the spherical shape that a given volume is contained within the smallest superficial area. This law of course holds good in the case of the uterus. The transverse diameter therefore shortens, its antero-posterior grows longer. The longitudinal diameter of the uterus ought also according to the above law to shorten, but as a matter of fact it becomes increased, at any rate during the period of expulsion and at the end of that of dilatation. This increase is caused by the body of the fœtus undergoing elongation during a pain in the following way: when the uterus contracts in all directions towards its centre, the transverse section of the fœtal cylinder (which is strongly flexed upon its anterior surface) is somewhat diminished; consequently since its bulk as a whole remains the same, the longitudinal diameter must be increased. As a result of this elongation, the breech of the fœtus forces the fundus uteri upwards, and causes it to bulge in the same direction.

While the uterus is thus altered in shape, growing harder and more rigid during a pain, it also raises itself up to some extent from the underlying parts; it forces the anterior abdominal wall forwards, so that the fundus comes into contact with a larger area of the latter, without however the lateral obliquity being altogether lost. This change in position is materially assisted by the abdominal muscles; for the lateral muscles of the abdominal wall force the uterus towards the middle in between the recti, the descending diaphragm causes the anterior abdominal wall to bulge forwards, and presses the fundus uteri still further forwards and downwards. In this way the longitudinal axis of the uterus comes to correspond with or nearly with the axis of the pelvic inlet, and the uterus is fixed even more firmly upon the pelvic inlet, than it already was by its normal attachments and by its weight.

§ 153. The contracting uterus exerts a twofold action on its contents. First of all it compresses them everywhere equally, those contents (which are subject to the laws regulating compressed liquids) exerting in return an equal and similar pressure on the uterine parietes, which pressure tends to destroy their continuity. This constitutes the *general intra-uterine pressure* (I.U.P.), which leads to the opening up of the lower segment of the body, dilates the cervix, and causes the bag of membranes &c., to present. But as parturition advances, the contractions come to have a further effect. As mentioned above, the elongation of the fœtal cylinder which occurs during the pains, prevents the uterus from shortening itself in its longitudinal diameter, from assuming and maintaining the spherical form. Consequently the uterus exerts on the parts of the fœtus which cause this interference, *i.e.* on the terminal points of the fœtal axis, a pressure which is in proportion to the efforts of the uterus to assume the spherical shape, and to the degree of fœtal elongation. This *pressure on the fœtal axis* (F.A.P.) is called the *form-restitution force of the uterus*.

The general intra-uterine pressure and the pressure exerted on the fœtal axis, constitute the sum total of the pressure exerted by the uterus during labour. The intra-uterine pressure, which rises with increasing contraction and with the emptying of the uterus consequent upon it, is the most important expelling force; as long as the ovum is intact and no considerable portion of it has left the uterus, it is alone operative, and all the more so the nearer the shape of the uterus has approached to that of a sphere (as when the quantity of liquor amnii is excessive); indeed it may under some circumstances alone complete the expulsion of the ovum. In no period of labour is this force entirely absent, when the whole uterus is contracting. The pressure on the fœtal axis only begins to be exerted at the end of the first, and during the course of the second period of labour, when the lower pole of the ovum, or the presenting end of the fœtus, meets with considerable resistance to its advance. Its operation however may begin earlier, when very little or no liquor amnii is present; it acts the more energetically, the further the uterus deviates from the spherical shape.

Owing to the additional *pressure* which the *abdominal walls* exert on the walls of the uterus (*cf.* § 144), the force of the uterus, the eneral intra-uterine pressure on its contents, increases con- nually, till the child is completely expelled. The abdominal alls press the uterus down upon the pelvic inlet, and increase ie frictional resistance between the latter and the lower portions f the uterus; in this way they prevent the uterus from gliding way over the inlet, which thereby has another opportunity of kerting its moulding influence on the fœtus. Moreover they ssist (*cf.* § 145) in the opening up of the lower segment of the terus, and lastly bring the direction of the uterine pressure, hich is that of the uterine axis, into a direction which is per- endicular to the plane of the pelvic inlet. (According to Schatz, ie resultant of the total force lies at an angle of 10° behind the xis of the brim.)

§ 154. Attempts have been made to determine the amount of orce which the uterus develops during labour, partly by means f manometric observations, partly by experiments on the power f resistance of the fœtal membranes. Schatz found that the ressure in a quiescent uterus during pregnancy, as also during he intervals between the "pains" (so long as the muscular all of the uterus had not become thickened), amounted to 5 mm. ·2 in.) of mercury, that the maximum pressure employed in xpelling the ovum (including the action of the abdominal nuscles) varied from 80 to 250 mm. (3—10 in.), that the force ecessary for the expulsion of the head amounted from 19—60 lb. 17—55 *Pfund*). Poppel, basing his calculation on the force equired to rupture a piece of fœtal membranes, whose surface neasured 5 cm. (2 in.) in diameter, found that in easy labours he head passes through the pelvis with a force of 4·5—21 lb. 4—19 *Pfund*). Duncan found that when the diameter of the iece of membranes experimented with was 4½ inches, the force ecessary to rupture them varied from 4—37½ lb., averaging 6¾ lb.; he concludes from this that in very easy labours the œtus may slip out by its own weight, since in many instances he force used to rupture the membranes is sufficient to expel he child also; in difficult labours, on the other hand, the force nay be considerably increased. All these calculations however re open to great sources of error; the method that is based ipon the resistance of the fœtal membranes, to the fallacy that he liquor amnii lying in front of (below) the head, is not ecessarily under the same pressure as the rest of the uterine contents; the manometric method to the sources of error which inevitably accompany this mode of estimation.

As the uterus becomes more and more contracted, and consequently emptied, its volume and capacity diminish, so that when the organ is completely emptied, the anterior and posterior walls lie in contact; at the same time the walls are increased 2—4-fold in thickness. This alteration is partly effected by a shortening and thickening of the muscular bundles, and by a change in their relative position; bundles that before lay side by side now lie one beneath the other. But the chief cause is the shortening and the thickening of the muscular fibres themselves, which change results in part from a cessation of the elastic tension, in part from actual contraction. The muscular fibres continue in this state of contraction, or rather of *retraction* (tonus), after labour, as is best proved by the pathological conditions of relaxation and enlargement of the uterus, which are met with *post partum*.

§ 155. The *dilatation and canalisation of the cervix* are brought about by the general intra-uterine pressure, owing to the less power of resistance which the cervix possesses, and which is dependent on the slighter formation of the whole lower segment of the uterus, on its physiological softening, the absence of pressure exerted by the abdominal muscles at this spot, and finally on the attachment of the uterus to the pelvis. The weak lower segment of the body of the uterus (*i.e.* the small lower end of the uterine ovoid, or area of expansion—Duncan, *cf.* § 69), whose upper margin forms approximately the boundary of the *firm* attachment of the peritoneum to the anterior and posterior uterine walls, cannot long resist the pressure which the compressed ovum exerts on the uterine parietes during the "pains," which pressure increases as the pains grow stronger. This segment therefore gives way, becomes stretched, and its wall would tear, did it not open up more and more during the pains, and especially did not the os form a vent, which, through a radial recession of its edges, compensates for the expansion.

As long as the pregnant uterus is quiescent, there are only the weight of the fœtus and the intra-abdominal pressure to act on the internal os; but as soon as contractions commence, the edges of the os are drawn apart; and since the os is the only point which offers no resistance to the pressure of the uterus on its contents, the latter will pass into the gap, and dilate it more and more. The cervix thus dilated forms a highly elastic canal, for its muscular fibres, though only weak, are nevertheless contractile. But it becomes to some extent elongated as well as dilated, and this elongation is all the greater, since the external os at first resists the dilatation, and the uterine muscularis in contracting retracts itself upwards along the ovum; further, the contractions near the cervix run mainly in a longitudinal direction. The dilatation and elongation of the cervix are considerably assisted by the action of the abdominal muscles, and by the attachment of the uterus to the pelvis. For while the action of the abdominal muscles, wherever these are in operation, is added to the resistance, which the wall of the uterus opposes to the pressure exerted upon it by its contents, the portion of the uterus projecting into the pelvis is deprived of this assistance. At the same time the action of the abdominal muscles is to force the whole organ into the pelvis, in consequence of which its pelvic attachments are put on the stretch, and hence a force is exerted on the lower segment of the uterus tending to pull it in different directions. Through this traction on the cervix, the edges of the external os become so much stretched, that they also give way, and are retracted over the ovum.

The cervix uteri and the lower segment of the uterus are thus drawn out to a greater length than they had before labour, and inasmuch as the distance from the external os to the fundus remains approximately the same, the contracting part of the body of the uterus is shortened to the extent of the above-mentioned elongation; moreover the internal os comes to lie at a greater distance from the external.

Thus in Braune's section of a parturient woman at the end of the first period of labour (fig. 45), the length of the cervix amounts to 10 cm. (nearly 4 in.), the length of the cavity of the uterine body to 18 cm. (7 in.), as compared with 26 cm. (10 in.), before labour[1].

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[1] That which Braune represents as cervix in figs. 44 and 45, appears to me to be both cervix and lower uterine segment, so that the ring which he describes as the internal os uteri, is really the lower border of that part of the body of the uterus which contracts during labour, the obstetrical internal os. This view is supported by the high position of Braune's internal os, and by the transverse furrow seen in the figure lying immediately above the upper edge of the symphysis in Braune's cervix, and which appears to me to be the upper border of the true anatomical cervix. The only way in which Braune could have proved that the portion lying between this furrow and the orificium internum, was really cervix, would have been by demonstrating that it was lined with cervical mucous membrane, which was not done. Moreover the pelvis of this preparation appears to be somewhat contracted.

As a result of this shortening, the body of the uterus has retracted itself from the ovum, and since the latter does not lie free, a separation of the fœtal membranes from the uterine wall must necessarily take place; this does not happen merely when the membranes project through the external os (when the membranes "present"), but to a certain extent during the dilatation and elongation of the cervix, since there was no connection between it and the ovum. How far this separation extends, depends mainly on the elasticity of the membranes; the less the elasticity, the greater the separation.

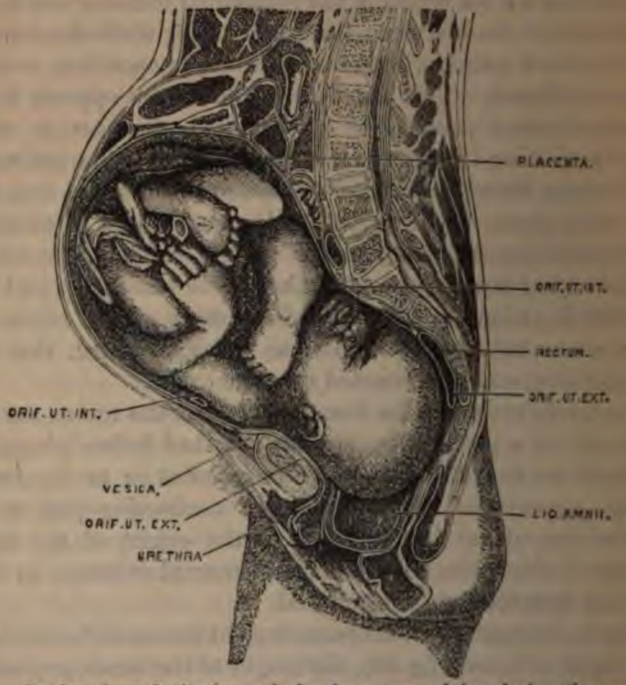

Fig. 44.—Section through the frozen body of a woman, dying during the period of expulsion. (After Braune.)

The shortening of the body of the uterus terminates at the pelvic attachments of the cervix; and if the external os is fully dilated, the increasing contractions will, with the assistance of the abdominal muscles, force the ovum through it into the vagina. Cervix and vagina now form a wide cylindrical canal, which is continuous without any sharp projection with the uterine cavity; the presenting part of the fœtus, almost always the head, lies entirely within the cervix, the obstetrical internal os lying on a level with or even above the shoulders of the fœtus (*cf.* fig. 44).

These various changes are not infrequently somewhat different in *multiparæ*, since in them the head does not as a rule lie so deep at the commencement of labour, and is not so firmly pressed down upon and into the internal os, as in primiparæ; moreover the action of the abdominal muscles is feebler, the attachments of the uterus looser, and the lower portion of the cervix and especially the external os generally offer less resistance. Hence it follows that when the internal os opens up, the external often follows suit, and the canal of the cervix continues for a while to retain its cylindrical form (*cf.* § 69). But with a given width, the relations are such as are described above, except that owing to the very yielding character of its lower portion, the expansion

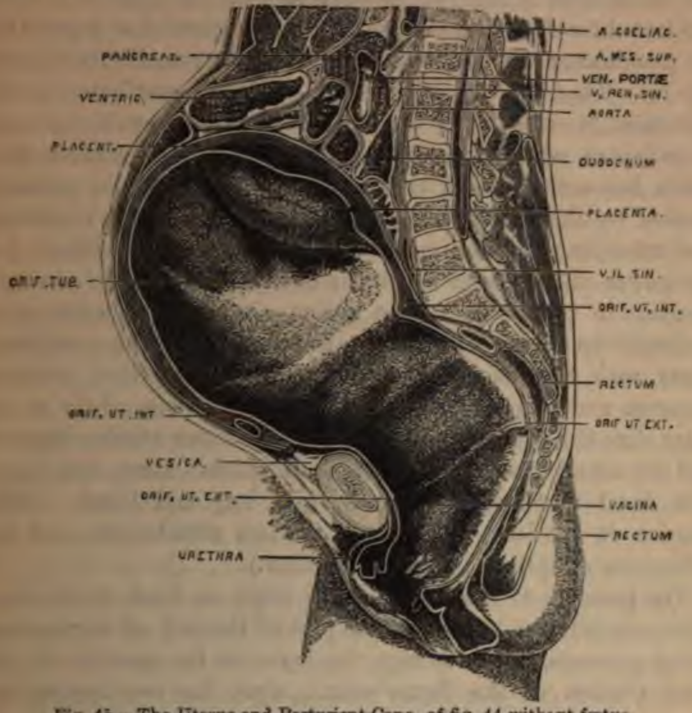

Fig. 45.—The Uterus and Parturient Cana of fig. 44 without fœtus.

and elongation of the cervix are often less marked than in primiparæ.

§ 156. The *bag of membranes* plays a very important share in dilating the cervix. The compressed liquor amnii receives the whole of the pressure of the uterine parietes, and therefore seeks to escape, as mentioned above (*cf.* § 155), in the direction of the os, and at this point causes the membranes to bulge. The greater the elasticity of the latter, the further will they protrude, and the greater is their wedgelike action on the edges of the os; the less their elasticity, the more force is expended in separating the membranes from the decidua, and the less remains for dilating the os. That the bag of membranes really contributes to the dilatation, is evidenced by the fact that the cervix again contracts or collapses, when the membranes rupture before complete dilatation has occurred. With the widening of the os, the pressure exerted on the portion of the membranes lying in it increases, and indeed in proportion to the superficial area of its orifice; but the power of resistance which the membranes possess, can only increase in proportion to the radius, since the pressure must evidently be distributed on the fixed points of the periphery. Thus with increasing dilatation the disproportion between pressure and power of resistance constantly rises, while at the same time the counter-pressure which the lower uterine segment and its elastic reaction can exert, diminishes more and more. The fœtal membranes therefore give way and burst. (The chorion is the least resisting of the two membranes, and not infrequently ruptures before the amnion.)

The pressure of the liquor amnii lying in front of the head (*fore-waters*), the tension of the part of the bag of membranes which presents, is not always the same as the pressure in the other portion of the liquor amnii, since the two masses are separated from each other by the cranium, which is in all round contact with the lower segment of the uterus. The head here acts like a ball-valve, and as such transmits pressure from within outwards. It is however not only in contact with the uterine wall, but also stretches it (in virtue of its weight). The pressure in the fore-waters compared with the general intra-uterine pressure, is therefore modified with the degree of this stretching. The two will be equal, when the segment of the uterus bounding the fore-waters and the head, is uniformly and easily stretched; but when during a pain the head is forced downwards owing to the I.U.P.[1] (the head being closely adapted to the uterus), the presenting part of the bag of membranes is more and more protruded, and ruptures. But if the lower segment of the uterus is unusually strong, and resists the pressure, so that the head cannot move downwards, then the pressure in the fore-waters will remain less than that in the remainder of the liquor amnii, and under such circumstances a "caput succedaneum" may form on the head, while it is still within the bag of membranes. If a portion of the cervix lying considerably below the head, especially one situated near to the external os, is very resisting, then as the compression of the fore-waters increases with the pains, the former will push the uterine wall before them at the point where it is in close contact with the head, and will recede into the cavity of the uterus, and the head under these circumstances will only descend in consequence of the I.U.P. and its weight, and only simultaneously with the whole lower segment of the uterus; this may indeed lead to an entire disappearance of the fore-waters. The same may also occur when the membranes are very resistant; the fore-waters may be completely pushed aside, and the membranes thus become an obstacle to the advance of the head.

§ 157. After the bursting of the membranes, the I.U.P. continues to operate, forcing the head, *i.e.* the lower end of the ovum, down through the os, and causing this to be obliterated, if not already so. The more the fœtus passes out of the uterine cavity, the smaller does the latter become, and the more also is the transverse section of the fœtal cylindrical mass diminished, and since its volume remains the same, the length of the cylinder must be increased. The uterus however in its vigorous efforts to shorten itself in the direction of its length, acts more forcibly than ever on the body of the fœtus, in a direction parallel to its own longitudinal axis. At this stage also the F.A.P. comes into full play, and, assisted by the abdominal muscles, is the main agent in driving the fœtus through the small pelvis. The soft parts lining the latter have no influence over this movement, but those lying at the outlet, *i.e.* in the pelvic floor, are very important. As the head is forced down vertically upon this floor, the latter is stretched (as described in § 148), the lowest portion of the vagina is elongated, its orifice is displaced forwards, and comes to be almost vertical. The pelvic floor thus forms a gutter-shaped pouch running forwards from the bony outlet of the pelvis, and in the formation of this "*perinæal canal*," that part of the perinæum which lies between the anus and the point of the coccyx (posterior perinæum), also takes a share. The perinæum in virtue of its elasticity and high tension, exerts a great influence over the movement of the head.

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[1] *Cf.* § 153 (Tr.).

When the head is born, the anterior and posterior walls of the body of the uterus lie in contact with each other, and the delivery of the body is largely due to the abdominal muscles co-operating with the uterus. We have already, in § 149, spoken of the expulsion of the placenta.

§ 158. *The movements which the fœtus makes during its passage through and its exit from the pelvis*, are by no means merely progressive movements, for the fœtus, and especially its head, are subjected to rotations due to the resistance offered by the parturient canal.

The head enters the small pelvis in the position and attitude which it occupied when above the brim, and inasmuch as the uterine axis is approximately at right angles to the plane of the brim, the circumference with which the head engages, *i.e.* the transverse diameter of the head, lies parallel to the brim. It is only when the head is obstructed at the very outset, viz. at the inlet, and the vertebral column of the fœtus is consequently rendered unusually convex in relation to the anterior uterine wall (owing to the fundus uteri as it endeavours to move forwards being forced further back by the abdominal muscles than are the deeper parts of the organ), that the head is inclined towards the posterior shoulder, that the base of the skull is pushed forwards, and the transverse diameter of the head forms an angle with the plane of the inlet, causing the sagittal suture to pass somewhat further back (Nægele's obliquity). The head is next driven directly downwards, in such a way that it retains the same relation to the imaginary planes running parallel to that of the inlet all through the small pelvis; it is therefore forced onwards in the axis of the brim. This condition of things is maintained, till the head reaches the lowest part of the posterior pelvic wall (which looks forwards and downwards), and the floor of the pelvis. The latter resists the force with which the head is pushed against it at an angle which opens anteriorly, and hence the presenting part of the fœtus is driven in a direction which is the resultant of these two forces, that is forwards and downwards towards the aperture of exit of the parturient canal (*cf.* fig. 14, § 35).

§ 159. The resistance which the pelvic canal opposes to this progress, causes the head, as already mentioned, to rotate, first on its transverse, then on its longitudinal, and lastly again on its transverse axis.

The first rotation causes the *head* to be *increasingly flexed* on the trunk, in consequence of which the occiput is depressed. The force exerted by the uterus is transmitted to the head through the vertebral column, and this, being articulated nearer to the occipital than to the anterior end of the base of the cranium, converts the head into a lever with unequal limbs, of which the occipital is the shorter; hence the resistance, being equal at both ends of the head, must act most on the anterior limb of the lever, and retard its progress. The occiput must therefore descend yet further, and it will do this all the more, since its convexity is much greater than that of the frontal half of the head; if therefore the parturient canal is distended by the propelled head, the occipital portion will be more likely to get room for its advance than the broad and less convex frontal region. Thus the force of the pains has most effect on the occiput, and results in so strong a flexion of the head that the chin is pressed against the chest, and the suboccipito-parietal plane comes to occupy that plane of this part of the pelvic cavity, which is parallel to the brim; indeed in cases of great obstruction, the occipito-mental diameter almost corresponds with the direction of the pelvic axis, and the point of the occiput lies in a nearly direct continuation with the vertebral column.

The *rotation on the longitudinal fœtal axis* occurs in the lower portion of the pelvic cavity, and is a gradual movement accompanying the progress of the fœtus; the latter therefore describes a spiral. By means of this rotation, the presenting part of the fœtus comes to lie more and more in the sagittal median plane, *i.e.* under the pubic arch. The rotation of the head depends in part upon a similar movement of the trunk, the dorsal surface of which (as the uterus continues to diminish in size) avoids the sacro-lumbar promontory (*i.e.* the obtuse angle which the posterior wall of the small pelvis forms with the large), and moves forwards where there is more room. But the chief causes of this rotation of the head are on the one hand the direction of the posterior division of the inclined planes of the ischial bones (*cf.* fig. 12), and especially the resistance of the projecting ischial spines, which compels the portion of the fœtus which lies anterior to them to move forwards, the part lying behind them to move backwards towards the sacral concavity; on the other hand the resistance of the pelvic floor, which inasmuch as it directs the head forwards, must of course begin by forcing the lowest part of it in that direction. Meanwhile as the head alternately advances and comes to a standstill, its smooth surfaces adapt themselves to the shape and cavity of the canal in which it lies, and finally when its lowest portion has reached the aperture of exit of the parturient canal, it is retained in this position by the stretched pelvic floor, and especially by the muscles of the latter (levator ani), which are thrust apart.

When the lower part of the fœtus reaches the vulva, the neck locates itself against the symphysis, the great mass of the head is placed on the pelvic floor, and the forehead occupies the sacral concavity. At this point the head again *rotates on its transverse axis*, but this time it is a *movement of extension*, ending in delivery. The expelling forces, continuing to act as before in the direction of the axis of the brim, drive the head against the posterior portion of the pelvic floor; this latter however forces it forwards, and since the neck is squeezed against the anterior wall of the pelvis and fixed, the head turns upon this point as a *point d'appui.* The occiput being the lowest part, ascends in front of the symphysis, the pelvic floor presses on the forehead and forces it forwards, the occiput rises more and more, and the elasticity of the perinæum, as it undergoes retraction, at last forces the face out of the body.

But not only does the presenting part of the fœtus rotate round the longitudinal axis, its whole body does so too; for the amount of resistance proffered by the anterior and posterior fœtal surfaces to the extension of the body by the pains is unequal, and this circumstance, as well as the previously described influence of the sacro-lumbar promontory, must cause a rotatory to be associated with the progressive movement. The whole body of the fœtus however does not rotate to an equal extent, for that portion of it which remains high up in the body of the uterus, lags about 30° behind the deepest portion (Schatz). Thus the fœtal cylinder becomes twisted, and causes the body of the uterus to be so also to some extent; indeed the whole parturient canal shares in a varying degree in all the rotatory movements of the fœtal cylinder. Meanwhile the advancing fœtal cylinder becomes more and more elongated, as it leaves the cavity of the body of the uterus, for the latter contracts more and more towards its centre, and grows narrower transversely. Hence result displacements and changes in the distance between particular uterine zones and the fœtal zones corresponding to them; those that take place in a transverse direction are more important than those in a perpendicular direction, since of course the fundus always remains in close contact with the breech.

After the birth of the head, the presenting portion which looked forwards as it made its exit, again turns to the side, a proof that the previous rotation to the front had only been partly followed by the trunk, and that the neck had been somewhat twisted. The *delivery of the trunk* takes place by means of a *fresh rotation round the longitudinal fœtal axis*, through which the binacromial diameter (as previously the head was) is brought into the median sagittal plane; but this rotation takes place in a direction the reverse of that which the head previously underwent, and the occiput turns directly to the side. The trunk is now (corresponding to the pelvic curve) bent towards the side which is directed forwards, and this curve increases, the further the shoulders are forced downwards. The latter therefore do not pass down symmetrically; the anterior is somewhat detained at the pubes, while the posterior rapidly advances from the coccyx over the perinæum to the posterior vulvar commissure. If now the point of the posterior shoulder has traversed the posterior commissure, the binacromial diameter lies in the antero-posterior diameter of the vaginal orifice, and both shoulders are delivered simultaneously; in rare cases, when the pelvic floor is narrow and offers little resistance, the posterior emerges somewhat before the anterior. The remainder of the trunk as a rule follows obliquely in the direction of one of the thighs of the mother, or occasionally, when the expulsion is rapid, in a straight direction between the two thighs.

§ 160. The *changes in the shape of the head* which take place during parturition (moulding of the head), and those which are caused by the mobility of the bones in relation to each other and by their flexibility (*cf.* § 106), will be dealt with, when the special mechanisms are described. But here we may say a few words more about the local swellings caused by labour, especially the "*caput succedaneum.*" This is a serous or even sanguineous infiltration of the skin, and especially of the subcutaneous connective tissue, causing them to swell, and thus giving them a sero-sanguineous appearance; in addition there is very frequently an extravasation beneath the periosteum. The swelling is due to the fact that the area on which it forms, is exposed to a less pressure than that lying about it; this leads to venous hyperæmia, to œdema and extravasation at that spot. The swelling generally begins by the skin being thrown into folds, owing to the greater pressure on the parts above it, and to the compression and distortion of the cranium. The swelling may form within the os, when the lower uterine segment is very much stretched and firmly applied to the presenting part, indeed under some circumstances it may appear before the rupture of the membranes (*cf.* § 156). As a general rule however it is first formed in the narrowest part of the pelvis or at the pelvic floor. Its situation will vary accordingly, and may be used after birth for a retrospective diagnosis of the position, provided that the stage of labour at which the swelling was formed, is accurately known, since the part exposed to the least pressure may vary with the various stages. The size of the swelling depends on the length of time which it has taken to form, and on the amount of pressure.

§ 161. *Influence of the pains on the distribution of blood in the uterus and placenta.*—So long as the general intra-uterine pressure acts alone, the placenta of course is neither compressed nor expressed, nor can the umbilical cord be exposed to any injurious pressure. The maternal placenta continues to discharge its blood into the maternal channels. But during a pain the tissues of the uterus become pale, its efferent channels are over-filled, and a considerable portion of the uterine blood must therefore be expressed. Moreover since the blood-pressure in the arterial system is higher than that in the venous, the latter is most rapidly and easily emptied, the arterial channels being so only at a later period, when the pains have increased in force. But the blood squeezed out of the uterine walls cannot flow into the placenta, since the vessels passing through the uterine tissues to the placenta are exposed to the same pressure as the contents of the uterus, inasmuch as the tension of the uterine wall is equal to the degree of contraction of the muscular fibres (these of course form also the walls of the blood-vessels), and therefore to the degree of compression of the contents; the result is that as the pains grow stronger, a larger quantity of blood flows out of the veins, while less blood enters the arteries, and the maternal placenta is emptied by means of the maternal channels. Probably as a general rule this momentary emptying has no influence over the fœtal circulation, though in some cases slight symptoms of dyspnœa might be caused. At all events the effect is of no importance, and therefore so long as only the general intra-uterine pressure is acting, it is but very rarely that any alteration in the fœtal pulse is noticed during a pain. The trifling retardation which is occasionally observed must be looked upon as due to an increased general intra-uterine pressure, or to a stimulation of the origins of the vagi by compression of the cranium (*cf.* § 119).

The conditions of the placento-fœtal circulation alter when the body of the uterus has undergone considerable diminution in size, and when the general intra-uterine pressure is lessened as compared with other pressure relations. Owing to the contraction of the uterine walls towards the end of labour, the placental area is diminished, and the placenta itself is gradually detached. Consequently the interchange of gases is interfered with, and the fœtus, which hitherto had continued in a condition of apnœa, experiences a want of oxygen, which after delivery causes respiration to be a physiological necessity. The exciting cause however for the commencement of respiration depends not uncommonly on yet other causes, *e.g.* cooling of the fœtus, mechanical contact, and on the placental blood channels being squeezed in the direction of the fœtal heart by the expelling forces (associated with a contraction of the placental area), in consequence of which the smaller or pulmonary vascular circle becomes for the first time injected and filled. These accidental causes are however of secondary importance compared to the want of oxygen, and merely serve to start the respiratory rhythm *at the proper time.*

b. Special Mechanisms.—The Various Kinds of Presentation.

§ 162. In the preceding description of the progress of the fœtus through the parturient canal, its vertex was supposed to present in the usual way. In what follows, this description is to be more minutely detailed, and the variations in the mechanism, as met with in the different kinds of fœtal lie and position, together with their ætiology and diagnosis, are to be discussed.

As already mentioned in § 108, the fœtus is found at the commencement of labour either in the *longitudinal* or in the *oblique*, commonly called *transverse, lie;* and though the lie changes so often before labour, yet at the proper period for the pregnancy to terminate, the child is in the great majority of cases found in the longitudinal lie, and with its head turned towards the pelvis—*cephalic lie;* it is rare for the pelvic end to be directed downwards—*pelvic lie.*

When the fœtus is in the cephalic lie and its attitude is normal, the vertex lies in the pelvic brim—*vertex presentation;* if the chin is separated from the chest, and the occiput forced down upon the neck, the face presents in greater or less extent—*face presentation;* in rare cases a condition intermediate between the vertex and the face presentation is met with, and the forehead lies over the middle of the pelvis—*brow presentation.*

The attitude may also vary in the different forms of pelvic lie. The thighs and feet may be applied to the abdomen, and the pelvis be placed lowest—*breech presentation;* or the thighs may be separated from the abdomen, and stretched downwards, and the feet be lower than the pelvis—*footling presentation.* If the legs remain strongly flexed on the thighs, the knees may present—*knee presentation,* or one or both extremities may be stretched down (*incomplete and complete* footling or knee presentation). Amongst the various kinds of pelvic presentation, the breech alone is primary, footling and knee presentations being derived from it; the mechanism of all the pelvic presentations is the same as that of the breech. The mechanism of a face presentation, on the other hand, is very different from that of the vertex, and therefore, although the face presentation is merely an unusual attitude of the head, will require a separate description.

So also will the brow presentation. Thus we obtain the following presentations :—

I. Longitudinal lie of the fœtus	*a.* Cephalic lie...	1. Vertex presentation. 2. Face presentation. 3. Brow presentation.
	b. Pelvic lie.........	Pelvic presentation.
II. Oblique or transverse lie of the fœtus		Oblique or Transverse presentation.

If the relative *frequency* of these presentations is calculated from the records of lying-in institutions, it is found that ca. 95 vertex, and 3 pelvic presentations occur in every 100 labours ; somewhat over ·5 (1 : 180) per cent. of transverse, and ca. ·6 (according to Winckel's statistics 1—158) of face presentations. If the calculation is based upon a larger number of births and a larger area of population, the proportion especially of face and pelvic presentations diminishes, and that of vertex presentations increases. Thus out of 93·871 births in the Upper Rhine District of Baden, which I have added together from the records of Schwörer (Schneider's &c. *Annalen der Staatsarzneikunde*, 1846, Part 3 ; also *Programm*, Freiburg, 1857), of Hegar (*Verhandlungen der Naturf. Gesellschaft zu Freiburg*, 1864) and from those collected by myself (unpublished) during 1860—62, there occurred :—

	97·3	per cent.	vertex presentations.
289=1 : 324=	·3	,,	face presentations.
1491=1 : 63 =	1·59	,,	pelvic presentations.
732=1 : 128=	·78	,,	transverse presentations.

The greater frequency of face and pelvic presentations in lying-in hospitals is explained by the greater number of abnormalities that occur in them, since such cases are often taken to hospitals, just because they are abnormal. Further it seems that if the calculation is based on labours coming on at the full time and in well formed women, especially if plural births are excluded, vertex presentations are much more frequent, and pelvic presentations much rarer (1·5 per cent.). The brow presentation is the rarest of all.

Each presentation is subdivided into various *positions* (*cf.* § 110), according to the direction of the back of the fœtus. In the longitudinal lie, the dorsum is most frequently turned towards the left side of the mother—first position, more rarely towards the right—second position; as a rule the dorsum is at the same time directed towards the anterior surface of the mother, whence further subdivisions result (dorsum to the front=the first, dorsum to the rear=the second subdivision). With a transverse lie of the fœtus, the commonest position is that with the head to the left—first, the rarer one that with the head to the right—second transverse position; the direction of the back forwards or backwards here decides the subdivision (dorsum to the front=the first, dorsum to the rear=the second subdivision).

§ 163. The *diagnosis* between the different kinds of presentation can easily be made by the vaginal examination, provided the presenting part is within easy reach, the os sufficiently dilated, and the membranes are ruptured, or, if still entire, are at least relaxed, and contain little liquor amnii. But when the fœtus is high up, when the bag of membranes is tense and very full, when the presenting part of the fœtus is swollen and œdematous, the recognition of the latter *per vaginam* is often very difficult. The diagnosis must then *rest entirely on the external examination.* This, provided the tension and sensitiveness of the abdominal and uterine walls are not excessive and insuperable,—which rarely happens—always yields sufficient and often much more satisfactory information than the internal examination, and leads to far fewer errors. At the same time it throws light on the position, explains the characters discovered *per vaginam*, and enables us to recognise the latter with the least possible delay and discomfort for the parturient woman.

The physical signs of each presentation and position will be described in detail under the appropriate headings; here I will only mention the characters by which the separate parts of the fœtus may be recognised. As regards the *modus operandi*, I must refer to what has been said in §§ 114 and 116.

In palpating the abdomen, the two ends of the fœtal cylinder, head and breech, must first be sought for. The *head* is felt as a round, hard, fairly even, convex mass without marked projections; it is more movable than the breech, and can more easily than the latter be distinguished from its adjacent parts, owing to the presence of the neck. Further it can be made to ballote, like a ball immersed in a fluid, much more distinctly than can the pelvis, whose movements are hindered by its broad connection with the trunk. The ballotement is more obvious in the earlier months when the head is comparatively large, than in the later; in these on the other hand the head is distinguishable by its greater hardness. Occasionally the cranial bones may be felt through the walls to crackle, as parchment (parchment crackling) does when pressed upon, and this sign is of a special importance in doubtful cases. Sometimes also the head is recognised by the tapering occiput being distinctly felt through the abdominal walls. The *breech* may be recognised by its uninterrupted broad connection with the trunk, by its irregular shape, its inferior degree of hardness, and less distinct ballotement, and by the extremities which lie in close contact with it. The *back* of the fœtus is known by the long and broad even surface which it presents to the palpating hand; sometimes also its deep bony elements can be felt. The limbs are recognised as small irregular bodies which can easily be displaced, and which also change their position and attitude of their own accord.

In making the examination, the first question to be solved is, whether we are dealing with a longitudinal or a transverse lie, and if with the former, whether the head or the pelvic end is presenting. For this purpose the head is to be sought for first. As a rule it will be found just above the anterior pelvic wall, rarely in the fundus uteri; the breech will of course occupy the opposite division of the uterus. The presenting part of the ovum may either be freely movable above the pelvis and therefore easily reached, or it may have already engaged and become fixed in the pelvic inlet; in the latter case it can only be felt from the outside when the parietes are very relaxed; occasionally also the broad shoulders may be recognised lying above the pelvis and a diagnosis arrived at. But an internal examination will under these circumstances enable us to decide the question, since the presenting part can be very accurately explored *per vaginam.* If no large fœtal mass is found either in or above the brim of the pelvis, if too the fundus uteri is empty, the presentation (unless an excessive quantity of liquor amnii be the cause of the negative result) is probably transverse, a condition which will be confirmed by an unusually great transverse width of the uterus. A careful palpation will then reveal that the head and the breech are placed one at each side of the abdomen; the one being at a higher level than the other.

When the lie has been ascertained, there is usually no difficulty in making out the *position*, at least whether it is a first or a second. The dorsum throws light on this point, since, apart from the broad surface which it presents, the side with which it is in contact, always offers the greatest resistance to palpation; if the dorsum cannot readily be felt through the walls, an attempt may be made by pressing down deeply in the middle portion of the uterus to force the dorsum to one side, and thus to make it more accessible to palpation. The lower extremities will be found on the opposite side to the back, but their situation can only settle the position of the latter, when it is an exactly lateral one, which is not always the case.

Auscultation gives us the area at which the fœtal heart-sounds can be most distinctly heard, and thus materially fortifies or corrects the results obtained by palpation. Owing to the curvature of the fœtal cylinder, the dorsum as a rule lies in close contact with the uterine wall, and there is much less fluid between them than there is on the ventral side of the fœtus; the conduction of sound is therefore least interfered with on the dorsal side, and the fœtal heart-sounds will as a rule be loudest on the side which corresponds to the dorsum. Auscultation has thus a special value for diagnosing the *position*, more so than for determining the *lie*, although it is true that if the fœtal heart is very distinctly audible on one side, it is an argument in favour of the lie being longitudinal, and that owing to the relation of the thorax the fœtal heart-sounds are usually heard below the navel in head presentations, and above it in such of the breech. Nevertheless it is not uncommon even with a cephalic lie to hear the sounds most distinctly above the navel in the neighbourhood of the breech of the fœtus, especially when the dorsum is directed posteriorly, and the breech is in close contact with the anterior uterine wall. Indeed all these statements are liable to many exceptions, when there is good conduction of sound, and the fœtus is unusually extended. Even for the diagnosis of the position, auscultation can only be relied upon, when it accords with the results of palpation, for where the quantity of liquor amnii is small, the heart-sounds can often be perceived distinctly on both sides of the uterus. A special exception to the above rule occurs in face presentations, where, as a result of the great extension of the trunk, the latter is pushed towards the side away from the dorsum, and the fœtal heart-sounds can therefore be heard on the side that corresponds to its ventral surface.

I need scarcely mention that in deciding on which side the fœtal heart-sounds are heard most loudly, it is not so much the side of the abdomen, as that of the uterus which is to be considered.

§ 164. From the point of view of frequency, the vertex presentations are the only *normal* ones; all others are abnormal, and must therefore be numbered amongst the pathological occurrences, all the more as they on the one hand depend chiefly upon an abnormal fœtal attitude, on the other hand (and this is true even of the simple breech presentation, in which the attitude is normal) are associated with numerous perils for the mother or the fœtus. If therefore I describe some abnormal presentations immediately after those of the vertex, this is done as much for the sake of a connected account, as for the reason that when they are properly managed, the great majority of the cases terminate spontaneously and successfully for the woman concerned. The transverse presentations however will be dealt with under the abnormalities of labour, since it is only in very exceptional cases that they terminate without artificial interference, and without injury to mother and fœtus.

A. *Vertex Presentations.*

§ 165. The ætiology and diagnosis of vertex presentations need not be further referred to here, after what has been said in §§ 108—110, and in the preceding one. It may always be expected on *a priori* grounds, that, if the lie is longitudinal and if palpation has found the head to be placed just above the pelvis, the case is one of vertex presentation. This becomes a certainty when through the vaginal fundus (which is often pushed far down by the head) we are able to feel a large hard rounded mass with a smooth surface, and when, either through the relaxed membranes if the os is dilated, or directly if they have ruptured, the characteristic cranial bones with their sutures and fontanelles can be made out, while no part of the face is within reach.

The first position—dorsum to the left, the right side of the fœtus turned to the anterior surface of the mother, occurs in ca. 70 per cent. of all vertex presentations (I like Nægele only find ca. 65 per cent.); the second—dorsum to the right, left side of the fœtus turned to the front, in 30 per cent. In the former case the dorsum is as a rule also directed somewhat forwards, in the latter often backwards, although probably in the majority of cases sideways. The reason for this direction and for the great frequency of the first position, has been already given in § 110.

§ 166. The *mechanism* of the vertex presentations has been sketched in outline in §§ 158 and 159. The attitude, position (relative to the pelvis), and the direction in which progress is made in the different portions of the pelvis, are as follows: In most cases a portion of the vertex lies within the brim at the beginning of labour, and this portion is usually in the biparietal plane (fig. 46, A, B); in rare cases, where the resistance is very slight, in the occipito-frontal (C, D). When the head is still above the brim at the commencement of labour, it nevertheless enters in the biparietal plane; the forehead and occiput are nearly on a level, though the occiput lies as a rule a little deeper. The sagittal suture runs approximately in the transverse diameter or in the first oblique; this, as I have shown, depends principally on the relation of the uterus to the pelvis, and on the uterus being twisted to the right on its axis; the oblique entrance (Solayrès', or lateral obliquity) occurs in about 20 per cent. of all vertex presentations. With very favourable conditions as regards space, the sagittal suture, or at least its middle point, lies midway between the anterior and posterior walls of the pelvis, therefore in the transverse median plane; it is only when obstruction is met with early, *i.e.* at the brim, that the head inclines towards the posterior shoulder (*cf.* § 158), and the sagittal suture runs behind the transverse median line (Nægele's or biparietal obliquity).

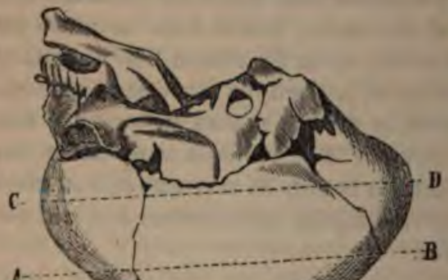

Fig. 46.

When the head is driven down, it becomes strongly flexed and the occiput is depressed; the degree of flexion depends on the amount of resistance met with, and as a rule increases, the further the head advances. At the same time the chin approaches the chest, the great fontanelle moves higher, to above the ilio-sacral synchondrosis, the small fontanelle approaches the middle of the pelvic cavity, and the occipito-mental diameter comes almost to correspond with the axis of the inlet, at any rate becomes perpendicular to the horizon (Rœderer's obliquity). The examining finger impinges upon the posterior portion of the parietal bone which is directed forwards, and since the head is not driven onwards in the middle line of the pelvic canal, but in the direction of the axis of the brim, the anterior parietal bone must in the lower part of the pelvic cavity present to a greater extent than the posterior; the sagittal suture here always lies behind the transverse median line. Meanwhile the occiput becomes rotated forwards, owing to the rotation of the trunk, and to the resistance of the lower part of the posterior pelvic wall and of the floor of the pelvis (§ 159); the small fontanelle approaches nearer and finally glides out beneath and a little on one side of the symphysis; at this period it may be felt at the outlet of the parturient canal, while one side of the occipital region appears in it. Through the action of the pelvic floor, the occiput is driven more and more forwards, the neck comes to lie in contact with the posterior surface of the symphysis, and the forehead and the face pass down rapidly along the posterior wall of the pelvis on to the perinæum. Then follows the movement of extension of the head, as described above; the occiput moves up in front of the symphysis, and the vertex, forehead and face are delivered. The direction of the movement is that of the lower segment of the vagina, and runs almost at right angles to the axis of the inlet, that is to the direction of movement within the pelvic cavity.

When the head is completely expelled, the occiput, which has hitherto been directed forwards, again turns to one side, since the shoulders have not rotated to an equal extent round the perpendicular diameter. They lie rather between the transverse and the oblique diameters of the pelvic cavity, the opposite to that in which the sagittal suture was previously placed. The deeper the shoulders descend, the more do they approach, as did previously the sagittal suture, the antero-posterior diameter of the outlet, and the occiput now turns again directly to one side, so that the face looks straight at the opposite thigh. The further movements associated with the exit of the trunk are described in § 159.

§ 167. The course of events and the physical signs found in a *first vertex position*, are the following: The back of the fœtus looks to the left, the feet lying in the right side of the fundus; the cardiac sounds are audible on the left side of the mother, and below the level of the umbilicus. The sagittal suture runs in the transverse or in the first oblique diameter of the brim, the small fontanelle is opposite the middle of the left ilio-pectineal line or above the left foramen ovale, the right parietal bone is directed forwards. The small fontanelle soon descends, and turns to the left side of the body of the os pubis; the great fontanelle moves higher up, and is as a rule quite beyond reach; the sagittal suture has crossed the first oblique diameter. At the outlet of the pelvis, the postero-superior quarter of the right and lowest parietal bone appears beneath the pubic arch, and is soon followed by the right side of the occiput, the occipito-frontal diameter lying in the direction of the conjugata diagonalis. The point of the occiput which is now in the vulva, passes up in front of the symphysis, while the vertex, forehead and face sweep forwards over the perinæum. The face when born, turns to the postero-internal side of the right thigh of the mother. The shoulders pass into and through the upper division of the pelvis, lying between the transverse and the second oblique diameter, the right one being placed against the right pubic bone, the left opposite the left ischiadic notch. The right then moves towards the symphysis, the left into the sacral concavity; in this position they pass out, and, as they do so, the face turns completely towards the inner side of the right thigh of the mother.

In a *second vertex position* the dorsum is turned to the right side of the uterus, and frequently somewhat backwards, the feet lying high up on the left; the fœtal heart-sounds are audible on the right side of the mother; the left side of the fœtus is turned towards the anterior wall of the uterus and pelvis. The sagittal suture in the upper portion of the pelvis lies in this case also in the transverse or first oblique diameter, and indeed for the reasons given above the oblique entrance occurs somewhat more frequently in this than in the first vertex position. The small fontanelle is in contact with (or below) the right ilio-pectineal line, or with (or below) the right ilio-sacral synchondrosis, and usually even at the start is somewhat deeper than the great fontanelle, which is turned to the left, or forwards and to the left. As the head descends, the occiput turns towards the right pubic bone, so that the sagittal suture comes to lie in the second oblique diameter. The further progress is similar to that in the first position; the postero-superior quarter of the left parietal bone moves from the right forwards to the pubic arch, and is soon followed by the left side of the occiput and the small fontanelle, the head passing out as in the first position; the face when born, looks towards the postero-internal side of the left thigh of the mother. The shoulders pass through the pelvis, lying between the transverse and the first oblique diameter, the left lies against the left pubic bone, but soon turns towards the symphysis and passes out beneath it, while the right sweeps over the perinæum; the face then turns directly to the inner side of the left thigh.

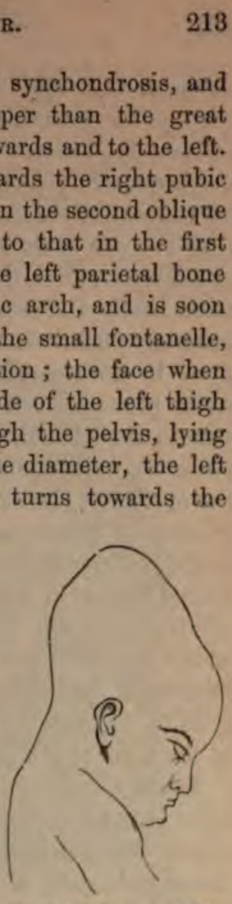

Fig. 47.—Shape of the head in vertex presentations (occipito-anterior position), with a well marked caput succedaneum.

§ 168. The *caput succedaneum* in vertex presentations is usually situated on the postero-superior quarter of the parietal bone which is directed forwards, since it is this portion which, when in the lower part and on the floor of the pelvis, projects into the lumen of the vagina, and afterwards beneath the pubic arch, and therefore is subjected to the least pressure. This statement however does not exclude the possibility of the swelling being formed at an earlier stage of labour, and therefore on a different part of the cranium than that mentioned (*cf.* § 160). Similarly, when the head passes very slowly through the genital fissure, and the occiput remains for a long time in the vulva, the swelling may extend on to the occiput (secondary caput succedaneum); indeed if the previous progress has been very rapid, it may form on it alone.

The *alterations in the shape of the head* itself consist in a compression of the suboccipito-frontal diameter (to which the greatest pressure is applied in the narrowest part of the parturient canal), and in an increase in length of the occipito-mental diameter (fig. 47). Hence the occipital and the frontal bones come to lie somewhat deeper than the parietals, and are pushed beneath the latter. This is the commonest alteration, although not invariably present, and it is greatly favoured by the anatomical connections of the bones[1]. Moreover in many cases (in more than two out of three) the two halves of the cranium come to lie at a different level, though only the parietals are as a rule affected, more rarely the frontal bones; the posterior parietal bone is generally pushed in beneath the anterior, since it is more pressed upon by the parturient canal than is the latter. Another effect of the pressure exerted on the transverse diameter of the skull is seen in the flattening of one parietal bone, almost always of the posterior, while the anterior becomes more convex; consequently the outline of the skull, when looked at from behind and above, is seen to be unsymmetrical (fig. 48). A lateral displacement of the two cranial halves in relation to each other in the occipito-frontal direction also occurs, the parietal eminence and the whole of one side lying further forwards than the other; in the vertex presentations this occurs on the side which is directed backwards, and the pressure exerted upon it by the promontory, is in many cases the cause. Still more obvious is the difference in the form of the temporal fossæ, the anterior being the deeper.

These alterations in the shape of the skull soon disappear after birth; it is very rare for one or other to last for a week or more. On the other hand there is a true congenital and permanent obliquity of the cranium, in virtue of which the left side is displaced backwards and upwards, and especially the left half of the occiput becomes more prominent and convex; the distance of the occipital protuberance from the parietal eminence is then less on the left side than on the right. Stadfeldt, who first described this asymmetry, ascribes it to the physiological and congenital sinuous formation of the axis of the cranium. The above-mentioned changes effected by the pressure of labour, usually obliterate this asymmetry (in the first vertex position, the left parietal bone is often pushed forwards), although it reappears shortly after birth.

§ 169. The following *modifications* of the ordinary vertex presentations as described above, may occur.

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[1] Even the connections of the tabular with the basilar portion of the occipital bone admit of considerable movement.

a. The head may enter the brim in the second oblique diameter, with its occiput directed forwards or backwards. The first of these varieties—*originally called the second position,* is not frequent; still rarer is it for the occiput to be directed backwards and to the left—the so-called *fourth position.* This latter position may also arise within the pelvic cavity at a later stage of labour, in cases where the head has engaged in the brim in the usual first position, but where the occiput rotates backwards instead of forwards. Similarly, when the head has entered obliquely in the second position, occiput backwards and to the right, the usual rotation forwards may fail to take place; the occiput continues directed backwards, and gives rise to the so-called *third position.*

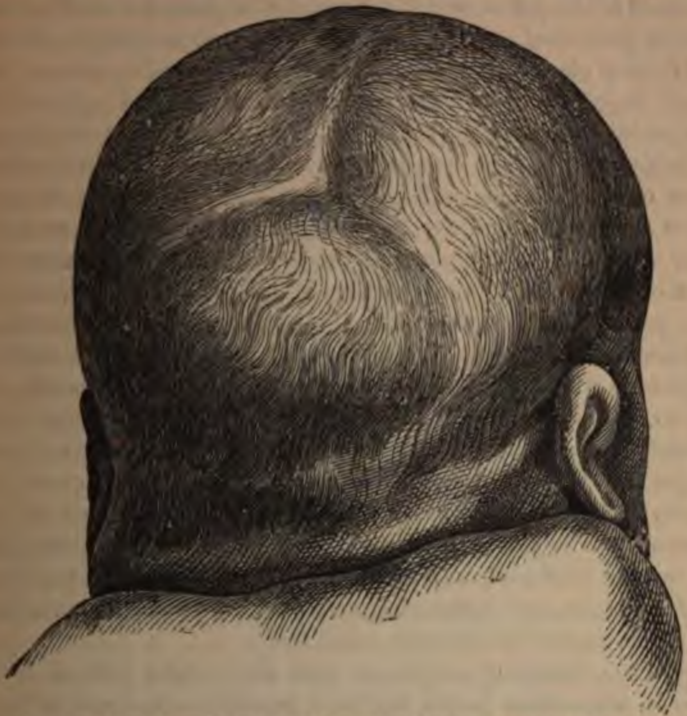

Fig. 48.—Fœtal head born in the second vertex position (moderate pelvic contraction). (After Braune.) (From fig. 44.)

In these positions the occiput is turned to the ilio-sacral synchondrosis, the forehead to the opposite ilio-pectineal eminence, and the anterior fontanelle lies at a somewhat lower level than the posterior; the examining finger impinges upon the parietal eminence, and the part in front of this lies in the axis of propulsion. The head may be born in this position, or the occiput may turn forwards even in the pelvic cavity, the *third being converted into the second*, the *fourth into the first position. Such conversion is the rule*, and always takes place when the head during its progress is subjected to a uniform pressure from all sides of the pelvis, and the occiput is nowhere detained by any special individual anomaly. When it does, strong flexion of the head takes place under the influences of the expelling forces, the small fontanelle moves forwards and downwards, and approaches the middle of the pelvic canal, the great one ascends; the forces of labour now become concentrated on the occiput, and the resistance of the posterior wall of the pelvis and of the pelvic floor drive it forwards, and expel it in the usual way. This rotation may take place in any plane of the pelvic cavity, either above or at the pelvic outlet, and the time of its occurrence depends on the period at which flexion of the head occurs. Sometimes it happens quite unexpectedly and rapidly, another time very slowly, especially when it only takes place in the lower portions of the pelvis, since the form of the skull has in such cases sometimes already become moulded so as to correspond with its unusual position. When however the rotation in the lower part of the pelvis is delayed, the case is more serious on account of the diminution in the size of the uterus which will by that time have been produced, and of the consequent threatened asphyxia of the fœtus; under such circumstances artificial assistance will be by no means infrequently called for.

§ 170. *The head passes out with the occiput rotated backwards*, when there is not sufficient resistance to cause it to be strongly flexed; birth in the third and fourth positions therefore occurs chiefly with small heads and wide pelves. It is noticed in 1—2 per cent. of vertex presentations, the exit in the third position being about twice as frequent as that in the fourth; moreover the head enters the brim with the occiput turned backwards and to the right, much more frequently than with it turned backwards and to the left. The great fontanelle is then lower than the small one, frequently in the axis of propulsion; the forehead, directed laterally at first, turns lly forwards, so that the great fontanelle at last lies over ium vaginæ and one frontal bone—in the third position , in the fourth the right—becomes visible in the genital ; the edges of the orbits and the nose can be felt behind ois. But the pains at last drive the occiput downwards to the perinæum, which it must traverse, and which it mperils in a very high degree. Inasmuch as the broad d cannot easily emerge from beneath the pubic arch, it is y compressed and flattened against the pubis, or else it somewhat upwards behind the pubic bones, and thus room for the occiput to glide out over the perinæum. this has happened, the head makes another movement of on, of which the neck firmly lodged against the anterior al commissure, forms the centre of rotation, and thus d, nose, mouth and chin pass under ut through the pubic arch. The ers pass through the pelvis in the e diameter to the one in which the l suture was previously placed.

e in delivery in the third and fourth ns, the occiput passes over the peri- the anterior segment of the vertex presenting portion; these positions herefore also been called (Wigand,) *anterior parietal* presentations. nally through depression of the an- part of the head, they are trans- within the pelvis into face or brow presentations, and *rsa.*

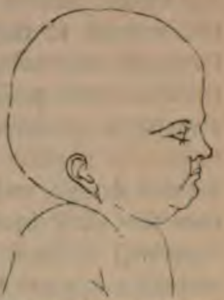

Fig. 49.—Shape of head with an anterior parietal presentation.

shape of the head born in an anterior parietal presenta- iffers materially from the cylindrical form which is met the usual vertex presentations, and is very similar to the l shape of the head. Since the pressure at the outlet is in the fronto-occipital diameter, the skull is shortened in d is elongated to make up for it in the vertical direction, the direction of the anterior parietal region lying in the of the pelvic outlet; the skull is therefore brachy- c; the head is high, the forehead steep (fig. 49). But he heads born in this position, have frequently but a small ference, they do not very often show this shape. The caput succedaneum is placed on the anterior angle of the parietal bone which looks forwards; sometimes on the great fontanelle, or even a little in front of it.

§ 171. *b.* Occasionally the head passes transversely through the pelvic cavity, and the sagittal suture is at the outlet in the transverse diameter—*deep transverse position of the head.* The delayed rotation round the long fœtal axis, is due to an absence of resistance to the progress of the fœtus. If the cause lies in the smallness of the head, or in the width of the whole pelvis being considerably above the normal, the head may also emerge in the same direction. But if, as happens in the so-called broad funnel-shaped pelves (increased width at the brim and in the cavity, with a normal width at the outlet), the head meets with the normal resistance at the outlet, it is detained there, and before passing out must rotate on its long axis. As a rule the occiput at this point rotates forwards, but if the great fontanelle lies relatively deep, the exit may take place in the third or fourth position. Since the accomplishment of rotation sometimes occupies a considerable length of time, the deep transverse position may cause a delay in delivery which is not without danger, and may require artificial interference. Moreover the skull in this deep position is affected by a marked biparietal obliquity, the anterior parietal bone presents, its eminence appears beneath the pubic arch, the great and small fontanelles lie far back, and are directed straight to the sides.

§ 172. *c.* In rare cases the head engages in the *antero-posterior diameter* of the brim, and retains this relation during its whole course through the cavity. Similarly there occasionally occur *retrogressive movements of the occiput, indeed complete changes in the relations of the head to the pelvis*, changes whose causes are difficult to explain not only from a general point of view, but often also in any individual case. Another abnormality consists in the head engaging in the brim of the pelvis with a *very marked inclination towards one shoulder.* It may incline towards the *posterior shoulder, i.e.* with a well marked Nægele's obliquity, so that the sagittal suture is found close to the promontory, and the *anterior parietal* bone covers the brim; this is scarcely ever seen except in a contracted pelvis, although it may also in an exceptional case occur with a normal pelvis owing to excessive anteversion of the uterus and to pendulous abdomen. Again, and this also is extremely rare with a normal pelvis, the head may be inclined towards the *anterior* shoulder, the sagittal suture lying near or in contact with and even over the anterior pelvic wall, and the *posterior parietal bone* covering the brim. These positions—called *anterior and posterior parietal positions*, or, since the ear of the presenting side can be distinctly reached, anterior and posterior *aural presentations*—therefore constitute a true *caput obstipum*. Their ætiology, when the pelvis is normal, is difficult to explain, but their termination at any rate is usually favourable; the abnormal cephalic attitude in the majority of cases is spontaneously rectified with the help of good contractions, or is set right by manual interference. If however the head remains in this position after the discharge of the liquor amnii, version must be resorted to, *i.e.* the head must be converted into a footling presentation; if this is impossible or cannot be executed without danger, the size of the head must be diminished, since it cannot be delivered in this unfavourable position, and the maternal passages when labour is prolonged, are exposed to an injurious amount of pressure.

§ 173. *d.* During the *exit of the shoulders*, rotation is not uncommonly absent, and the binacromial diameter passes through the pelvic outlet and vulva in the transverse position. In such cases the external rotation of the head is also absent. This is especially noticed when the head has made rapid progress, and there is a want of resistance at the pelvic floor, therefore most often in multiparæ and where the pelvic outlet is wide. Under these circumstances the shoulders sometimes pass out in the oblique diameter.

At other times the shoulders, as they pass out, rotate in such a way that they do not pass through the opposite oblique diameter to that through which the sagittal suture passed, but through the same; thus in the first position through the first oblique with the left shoulder forwards, in the second position through the second oblique with the right shoulder forwards. In such cases the occiput, when born, makes no retrogressive movement towards the side from which it rotated forwards, but a further rotation in the opposite direction, turning for instance in the first position towards the right thigh of the mother. In rare cases so extensive a super-rotation takes place, that the shoulders reach the oblique through which they ought to pass in the normal course of events, but with the dorsal and ventral fœtal surfaces reversed. The trunk has then rotated through a semi-circle, and the shoulders pass out *e.g.* after the birth of the head in the first position, as if it had been the third position. The cause of these abnormal rotations appears to lie mainly in the conformation and position of the uterus, to a less extent in the shape of the pelvis; it is no doubt sometimes due to the prolapse of the extremities by the side of the head, or to the umbilical cord being coiled round the child. These rotations are most frequently noticed: when the occiput is primarily directed backwards, therefore more often in the second than in the first vertex position; in primiparæ, owing to the greater tension of their uterine walls; and more often in forceps than in spontaneous deliveries. Where forceps have been used, the operation may have prevented the regular mechanism of rotation, or an already existing faulty direction of the shoulders in relation to the neck may have made the operation necessary.

B. *Face Presentations.*

§ 174. Presentations of the face are a variety of those of the head, in which owing to the great extension of the latter and to the occiput being approximated to the neck, it is not the vertex but the face which presents at the pelvic inlet; the forehead is here looked upon as a part of the face, although not anatomically belonging to it.

In order to bring about such an attitude of the head, there must be a force opposing the flexion of the head, and such a force can only be found in the conformation of the fœtus, or in some resistance on the part of the parturient canal. The fœtal head may no doubt remain extended for short periods as a result of reflex movements, but it will not retain that position except under compulsion. Face presentations therefore only occur, when contractions are present which drive the head downwards and compel it to assume a definite attitude, although this statement obviously does not exclude the possibility of the face persistently presenting for some time before the onset of true labour pains. I myself have noticed this, on one occasion five, on another eight days before the onset of labour; in the winter of 1877—78 we were able more than once for several weeks previous to delivery (which occurred at the proper time), distinctly to make out a face presentation through the vaginal fundus; parturition took place as a vertex presentation, the child being alive.

The extension of the head may be *due to the shape of the fœtus*, *e.g.* to a considerable enlargement of the upper thoracic region (I once met with a face presentation with a large hydrothorax), or of the anterior cervical region owing to a tumour (congenital goître). But in most cases the *determining force is exerted by the pelvic brim*, and a marked lateral deviation of the uterus and an oblique position of the fœtus are then of special importance. As the fœtal position is being rectified by the uterine contractions, the occiput may easily be caught and detained at the edge of the pelvic brim, especially when the dorsum is turned upwards. The uterus usually deviates to the right; by its contractions its action is exerted on the left side, and if the forehead, for instance, is directed to this side, it will be forced down. Hence also is to be explained the relatively great frequency of the second face position, as compared with the second vertex position. The development of a face presentation is of course favoured by any obstacles which in themselves are likely to lead to a depression of the forehead, or to a very transverse position of the head at the brim, therefore especially by a flattened pelvis (*cf. infra*); thus one contracted pelvis is met with in about every four face presentations. Moreover the head will be all the more easily extended, the greater the development of the occiput, since the longer the occipital arm of the cephalic lever, the less the resistance which will suffice to delay the occiput.

Hecker attaches most importance to this *dolicho-cephalic shape*, to the elongation of the posterior arm of the lever (from the foramen magnum to the point of the occiput) as compared with the anterior (from the foramen magnum to the chin), which characterises skulls born with the face presenting; they are moreover distinguished by a smaller perpendicular, by a large transverse diameter and by a generally increased circumference. It is undoubtedly true that the skull in which the difference between the anterior and posterior arms of the lever has become smaller, in which therefore the point of the insertion of the vertebral column, *i.e.* the point on which the expelling force acts, is nearer to the middle, *i.e.* nearer to the front of the head, can readily be induced to enter with the anterior surface of the head (instead of engaging like the ordinary skull with the posterior surface first), *i.e.* to engage as a face presentation, all the more so, when a relatively large transverse diameter favours such a position. Not only however is it a fact that the heads born in face presentations do not always present the dolicho-cephalic form, at any rate not in a marked degree, but this shape, where present in a characteristic manner, is not always primary, but has been produced by the pressure of labour, as subsequent measurements show; and the same shape of head is also met with in exactly opposite cephalic attitudes (entrance with the occiput lowest). Moreover in the skulls concerned, the posterior arm of the lever is always somewhat shorter than the anterior, so that, although we are willing to admit the truth of Hecker's statements as regards the original form of the skull in face presentations, that form is insufficient in many cases alone to explain the development of a face presentation.

Ahlfeld seeks for the explanation of this attitude in a *diminution of the fœtal reflex activity*, such as exists in premature, asphyxiated and dead fœtuses. But the view that face presentations are frequent in premature labours or with dead fœtuses, is contradicted by all our experience, although we have now satisfactory evidence of its occasional occurrence. In order to prove Ahlfeld's hypothesis, it should be shown that the percentage of face presentations is higher in premature, immature and dead fœtuses than in those that have reached the full time and are living.

Amongst other points in the ætiology, we must mention that *short* and *fat fœtuses*, *i.e.* those that are heavy in proportion to their length, very frequently present with the face. I myself amongst this class of new-born children, have found relatively many *girls*, perhaps for the reason that the male skull is on an average more frequently brachy-cephalic. *Coiling of the cord* round the fœtus is common. In my experience face presentations are more frequent in *multiparæ* than in primiparæ. It must further be noticed that the obstruction which leads to the presentation of the face may be caused not only by the pelvis, but also under some circumstances by the soft parts, *e.g.* by uterine tumours (Lüdicke, *Centralbl. f. Gyn.*, 1879, p. 212), or by the distended urinary bladder (Ahlfeld).

frequency of face presentations is, as already mentioned
62, much too highly estimated in the records of lying-in
tions. A more general census shows that a face pre-
ion occurs only once in 324 births, a proportion which is
imilar to that recorded in the great Rotunda at Dublin
ıs 1—497). The most common position, as with all
ndinal "lies," is that with the dorsum to the left. On
her hand the second is more frequent than it is with vertex
tations, doubtless owing to the fact that the uterus usually
es to the right side. (According to Hecker, with whose
s those of my Maternity correspond, 21 second occur to
st face positions=1—1⅓, while the relation in vertex
tations is 1—2·26.)

75. A face presentation may sometimes, when a part of the
an be felt above the brim, be *diagnosed* by the external
nation alone, the occiput being found pressed back against
eck. On one side is the resisting and tapering convex
e, which corresponds to the occiput and in the region of
ck makes a distinct angle with the trunk, while on the
side no part of the cranial vault is found. Even when
points cannot be satisfactorily made out, the presence of a
resentation is rendered very probable, when (as already
oned in § 163) the cardiac sounds are heard most distinctly
side opposed to that on which the dorsum is placed, but
ponding to the lower extremities. A vaginal examination,
when the head is still high, shows the vaginal fundus to
tened, the presenting part to be less movable than usual.
e latter may be felt through the fundus, small rounded pro-
ns on one side, on the opposite a broad bony surface, the
ad. When the os is patulous, the face presentation is
fied by the nose, on one side of which the eyes can be felt
heir prominent supra-orbital ridges and the forehead, on
her the mouth with the lips and alveolar edges, and (when
ead has moved further down) the chin. Sometimes too
ngue is detected within the mouth, and when the child is
sucking movements may be perceived. The direction of
se is the best guide as to the position. When the face is
swollen, it may be very difficult to recognise, and is most
to be confused with the breech. I have seen the swelled
vith the prominent eye-ball mistaken for the scrotum;

indeed in one melancholy instance the edge of the orbit was confused with the iliac crest, and a blunt hook was introduced into the orbit. In doubtful cases, the cavity of the mouth with the highly characteristic alveolar ridges forms the safest guide.

§ 176. The *mechanism* in face presentations may be deduced from that of vertex presentations, if the mento-frontal and bimalar diameters are substituted for the fronto-occipital and biparietal diameters of the vertex, and if it is borne in mind that the long axis of the face, owing to the direction in which the pressure of the propelled vertebral column acts upon it, is divided into two arms of a lever, the shorter one lying towards the chin, much as in vertex presentations the shorter is directed the opposite way towards the occiput.

The head lies above and enters the brim, with the axis of the face (drawn from the middle of the forehead between two frontal eminences to the point of the chin) running transversely or in the first oblique diameter, and owing to the greater frequency with which the uterus is rotated to the right, it lies more commonly in the oblique diameter than in vertex presentations. Moreover Nægele's obliquity is, for reasons already stated, more frequent than in the latter. The forehead lies at first at a somewhat lower level than the chin. But as the pains grow stronger, the resistance to the progress of the head acts on the longer arm of the facial lever, *i.e.* on the frontal region, and detains it, while the shorter arm, viz. the chin end, descends more and more; the head becomes more extended, the chin advances first. The latter must now however rotate towards the anterior pelvic wall (even though it may at the beginning have been directed backwards), owing to the same causes as in vertex presentations, when flexion has occurred, force the advancing occiput in that direction. But it may happen that a chin which is directed backwards is unable, with the ordinary relations of pelvis to fœtal head, to reach the floor of the pelvis, without also drawing the shoulders into the inlet, *i.e.* in addition to the head which is lying against the anterior wall and in the inlet (since the neck is too short, even with the greatest possible extension). Under such circumstances the labour comes to a stand-still, or, what usually happens, the chin passes out in front. The extension increases yet more, and the chin passes into the vulva and beneath the symphysis, while the shoulders remain above the anterior wall of the pelvis (fig. 50); the neck is squeezed against the symphysis, the head becomes flexed, and the forehead, vertex, and at last the occiput sweep over the pelvic floor, against whose anterior edge the neck rests, when the head has made its exit.

In the *first* face position, the forehead is found at the brim on the left side of the pelvis, as a rule directed somewhat forwards and lying a little deeper than the chin. As the head descends, the chin comes down and rotates from the right side or from its dextro-posterior position towards the front, so that the right cheek can be felt in the middle of the pelvis, and the line of the face in the second oblique diameter. The forehead approaches the sacral concavity, the chin advances from the right pillar of the pubic arch into the vulva, till at last the chin, though still inclined to the right, moves up in front of the symphysis and makes room for the skull to glide out over the perinæum. When the head is born, the face looks towards the upper side of the right thigh of the mother, and the delivery of the shoulders and trunk follows in the same way as in vertex presentations, being as in them occasionally subjected to irregular rotations.

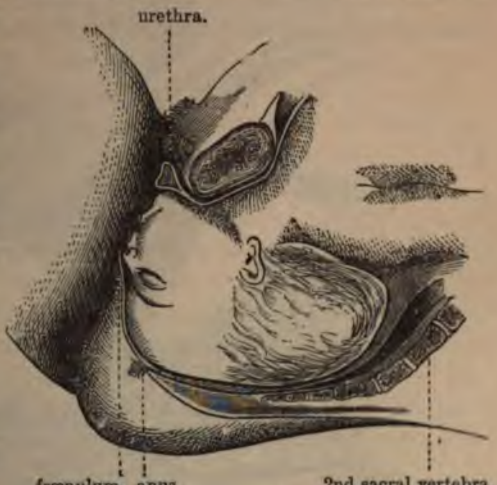

Fig. 50.—Face passing through the pelvic outlet and vulva. (After Schröder.)

The *second* face position runs a similar course, right and left being of course reversed. In this position however the chin is very often directed forwards from the very start, since the head so frequently enters in the first oblique diameter; the rotation of the head round the longitudinal fœtal axis is therefore as a rule less extensive.

If the *chin continues directed backwards*, the head can only be expelled when it is very small and yielding (*e.g.* with dead fœtuses), when the pelvis is wide and the perinæum very unresisting. To allow of delivery in this position, the neck must be very greatly stretched, as mentioned above, and the occiput and shoulders must enter the pelvis simultaneously with it; this can only occur, if the fœtus is compressed to a degree which is not possible under normal conditions. If occiput and shoulders have simultaneously entered the brim (fig. 51), the skull is squeezed against the anterior pelvic wall, the neck and thorax against the posterior, and all these parts are so pressed against each other, that any further stretching of the neck is rendered impossible and labour comes to a complete dead-lock. The case is of course different when there is no resistance, and to such a class belong the deliveries in the mento-posterior position which have been observed. In such the chin appears at the anterior edge of the perinæum, against which it is firmly pressed, while the head is released from its jammed position by a process of flexion, and the forehead, vertex and occiput successively pass down beneath the pubic arch and from before backwards.

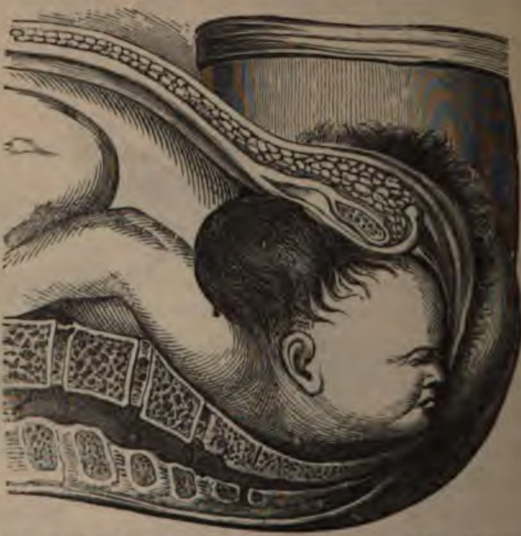

Fig. 51.—Face presentation, with chin directed posteriorly. (After Hodge.)

§ 177. The *sero-sanguineous swelling* of labour is very rarely absent in face presentations, inasmuch as they rarely terminate rapidly. The swelling is either placed chiefly on the occifrontal region or over the cheek, ala nasi, angle of the mouth and lips, according to the part of the parturient canal in which the delay was longest. Since the delay generally occurs at, or just above, the outlet, the last-named positions form its usual site. The swelling is always on the side directed to the anterior pelvic wall; and only when labour has been very protracted, does it extend to the other side of the face. Occasionally the whole face seems to be compressed in the transverse diameter, and its soft parts are pushed together towards the median line, so that the nose is flattened, the angles of the mouth are approximated, and the oral fissure appears to run vertically. The pressure in the transverse direction is sometimes followed by unilateral facial paralysis. The *skull*, through the great pressure against the lateral and posterior pelvic walls, is compressed and flattened from above downwards; the occiput especially becomes prominent, its under surface running in an almost horizontal direction; the forehead also is more projecting than usual (fig. 52). The vertical diameter of the head is shortened, slightly also the transverse; the occipito-frontal and occipito-mental are elongated, but the difference between them is less than normal. The skull in a face presentation is very similar to that met with in a well marked example of occipito-anterior presentation (*cf. supra*, and *sub* "Contracted Pelvis"). The pressure exerted in the direction of the vertical diameter, sometimes causes one parietal bone (and in such cases it is almost always the anterior) to be pushed under its neighbour; with a uniform strong pressure from the sides of the pelvis, both parietals may be pushed beneath the occipital and the two frontal bones. The neck too is frequently swelled, in consequence of the pressure and stretching to which it has been subjected, and the thyroid gland, owing to its temporary engorgement, is unusually prominent, sometimes as much so as in intra-uterine goitre. New-born children often hold their head in an extended position for some days after birth.

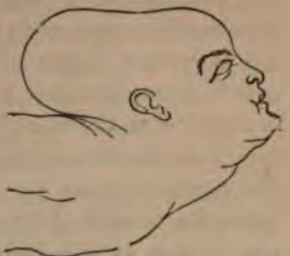

Fig. 52.—Shape of the head in face presentations.

§ 178. Face presentations as a rule terminate spontaneously and successfully, provided that the medical attendant watches patiently, and does not meddle. Nevertheless the *prognosis* is not quite so favourable either for child or mother as with vertex presentations, even when the mechanism is perfectly normal. In the first place the labour not uncommonly lasts longer than in vertex presentations, since it is the broad surface of the face and the still broader adjacent portions that pass through the parallel pelvic planes, and since a portion of the expelling force is expended on the neck and not directly on the head, owing to the cervical and thoracic regions of the vertebral column being bent back, and is consequently lost. The stronger pressure to which the fœtal head and parturient passages are exposed, increases the duration of labour, and in the case of the former the compression of the blood-vessels of the neck against the anterior pelvic wall is also of especial importance. Slight abnormalities such as in vertex presentations usually do no harm, *e.g.* a certain degree of uterine inertia, a moderate amount of pelvic contraction, or a somewhat rigid parturient canal, are enough, when the face presents, to endanger the life of the child, and often call for artificial interference, and this does not improve the prognosis even for the mother. Speaking generally, the mortality of both children and mothers is twice as great in the case of face as with ordinary vertex presentations, and of those that survive many have been injured.

§ 179. In *managing* a case of face presentation, a purely expectant attitude must be maintained as long as possible. In reference to this point I must refer the reader to the section dealing with the management of an ordinary case of labour, merely adding here, that every endeavour should be made to preserve the bag of membranes intact. For this reason vaginal examinations should be few and cautious, premature bearing down efforts should be forbidden, and the lateral posture enjoined, that side being selected on which the chin is placed, since its rotation forwards is thus favoured. After the rupture of the membranes still greater care in examining is necessary, lest the face and especially the eyes be injured, and lest air be prematurely admitted into the mouth. If the forehead remains for an unusually long time directed forwards or to one side, and the chin does not descend, counter-pressure is allowable in the lower portion of the pelvis, and is made by pressing with two fingers backwards and upwards against the forehead during the pains. Violent attempts to alter the presentation or attitude of the head are not permissible, when once the latter is fixed in the pelvic cavity. Special patience and care are necessary in supporting the perinæum, and above all things undue pressure forwards must be avoided, so as not to bruise the neck against the anterior pelvic wall. It is also advisable in these cases to support the perinæum and to allow the head to emerge, while the woman is lying on her side. The face of the new-born child is often greatly disfigured, and should not at once be shown to the mother; she may be reminded that the disfigurement will rapidly disappear in 1—2 days. It is necessary during the second period, and especially when the progress of the head through the lower half of the pelvis is delayed, frequently to examine the fœtal pulse, in order not to miss the right moment for interfering, should necessity arise. Interference however without definite indications is to be deprecated, as for instance simply on account of the delay in delivery; it is in such cases as these that interference is often punished in a most disagreeable manner.

Although a mainly expectant and observant behaviour was previously enjoined as the fundamental rule for our guidance in face presentations, this must not prevent an attempt being made *at the right time to convert a presentation which is followed by such unfavourable results, into the more favourable one of the vertex.* This remark of course does not apply to cases where the face is fixed; indeed even when the head is movable the greatest care is necessary. The attempt is made by bringing pressure to bear on the forehead or occiput *per vaginam*, with the object of pushing the face upwards, or drawing the occiput down, or of accomplishing both ends one after the other, or simultaneously by combined manipulation. These attempts are occasionally successful, and many instances of such success have been pubished; yet as a general rule the manœuvre is not to be recommended, since it cannot be carried out while the bag of membranes is intact, nor when the width of the cervical canal is mall; the fingers have no fixed *point d'appui*, the manipulaions involve the use of considerable force, and further, being made within the genital canal, cannot be harmless to the mother; finally, success is in a high degree uncertain. The best proceeding for rectifying the attitude of the head, consists in purely external manipulations, and if carried out in the way recommended by Schatz, these are well worthy of notice. In order to convert a face presentation into one of the vertex, the trunk of the fœtus must be pushed upwards in the long axis of the uterus, and for some moments the total length of that axis must be increased. If force is applied merely to the head, the opposite effect to what is desired, will follow; for when the head alone is pushed up, the long axis of the ovum is apt to be shortened, while by bearing down efforts and the excitement of contractions the injurious result is made even worse. All this is avoided, and the desired end is attained, if the shoulder and chest of the child are seized through the abdominal walls, and are pushed at first upwards and towards the dorsal side of the fœtus, and as soon as the chest and shoulders have been brought into the long axis of the ovum, only towards the dorsal surface. But in order that the whole body of the fœtus and the whole uterus may not be pushed towards the same side, the upper part of the uterus and the breech must be held in their previous position with the other hand, or still better be pushed towards the thoracic side of the fœtus, although this last movement must not in any way counter-act or neutralise the action of the first hand. If, when the pressure is exerted on the chest and shoulders in the direction of the dorsal surface, the head tends likewise to travel in that direction, a third hand will be able to prolong upwards, so to speak, the side wall of the pelvis which corresponds to the dorsal fœtal surface, and thus easily prevent the head from shifting its position. This procedure may be adopted towards the end of pregnancy, or during any part of the period of dilatation, provided the membranes are still intact, but not later. It postulates a great familiarity with the mode of making external examinations, manual skill, and a non-irritable state of the abdominal and uterine walls. Anæsthesia induced by chloroform, and sometimes also cautious co-operation *per vaginam*, facilitate its execution. It not uncommonly fails, but in such cases has at any rate done no injury. When successful, a relapse at least in the period of dilatation need not be feared, since the cervix uteri at this stage firmly embraces the head, and the shortening of the body of the uterus, already by no means inconsiderable, prevents a recurrence. At any rate rupture of the membranes would make it difficult for the head to become re-extended.

C. *Brow Presentations.*

§ 180. A presentation of the brow is one in which the extension of the head is not sufficient to cause a face presentation, so that a point near the middle of the frontal suture is in the line of projection, the forehead being the part which descends first (fig. 53). Such an attitude of the head is doubtless common above the pelvis, especially when the head is very movable, but it is very rare at the pelvic inlet or in the pelvic cavity, *i.e.* when the head is more or less fixed, since as the head enters the brim and descends, the propelling force is soon diverted to one or other side of the brow, and converts the brow into a vertex or a face presentation. The causes of a persistent brow are much the same as those of a face presentation: lateral deviation of the uterus or of the advancing head, pelvic contraction (especially in a moderate degree), an extra-median position of the head at the brim where the pelvis is greatly flattened (as in 2 cases under my care), and finally any obstruction which, when the brow has once entered the brim, makes this presentation permanent, and prevents its conversion into a vertex or face presentation.

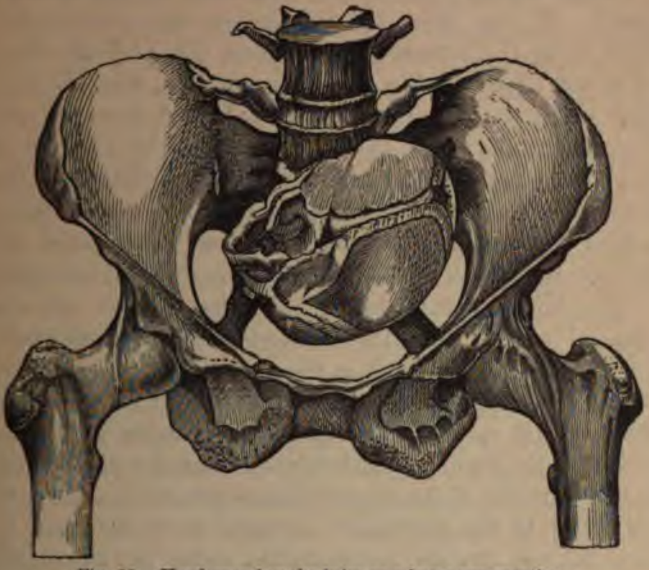

Fig. 53.—Head entering the brim as a brow presentation.

That great mobility above the obstruction which produces the brow presentation, predisposes to the latter, is shown by the relative frequency in which these presentations are associated with small fœtuses; thus out of 18 cases, I have met with it twice in premature labours (at the 28th and 30th weeks), once in both of twin fœtuses, and once with the first twin.

Brow presentations are diagnosed by the point of the forehead being felt to be the presenting portion, while the great fontanelle with the anterior parts of the parietal bones are discovered on one side of the pelvis, the root of the nose and the edges of the orbits, sometimes also additional parts of the face, on the other; the frontal suture lies in the transverse or in an oblique diameter. If the brow presentation is not converted into another under the influence of the pains, it is possible when the head is not large and the passages are wide, for it to be born without injury to mother or child. The *brow then turns forwards* and appears in the vulva, the eyes are placed beneath the pubic arch, while the superior maxillary region lies behind the symphysis, and the vertex on the perinæum and in the sacral concavity. The head now sweeps out from the latter, while last of all the upper jaw, the mouth and chin appear from behind the symphysis. The frontal suture during this process does not always correspond exactly with the antero-posterior diameter of the pelvis; it may make its exit in the oblique.

Delivery becomes more difficult when the *chin is directed backwards*, and spontaneous expulsion is under such circumstances scarcely possible. Indeed even when the position of the brow is favourable, if the space relations are at all unfavourable, either owing to the parturient passages or to the head, spontaneous delivery is only accomplished under the most extreme pressure on the head and contusion of the genital canal. With such conditions a labour in which the brow presents, is as a rule terminated by artificial means, and must be so.

§ 181. It will therefore be advisable if the brow presentation has been early recognised, and if the practitioner is satisfied both from the dimensions of the pelvis and the size of the head, that the labour will be difficult, to get rid of the brow presentation by podalic version of the fœtus. A *conversion into a vertex or face presentation by manipulations* is useless when the head is high and freely movable, since after removal of the hand the same causes which led to the brow presentation continue to act. Rectification may be attempted with better prospects of success, when the brow is already somewhat fixed in the pelvic brim; the best plan for attaining the desired end is to introduce the whole hand into the vagina and external os, and to grasp the occiput or the lower jaw, drawing it down towards the middle of the pelvis and holding it there during the next few pains. But the attempt will rarely succeed permanently; I have invariably failed, probably because at the time of the procedure the shape of the head had been already so much altered as a result of the brow presentation, that the skull could not easily and rapidly adapt itself to another position or presentation, and I doubt whether, when rectification was rapidly successful in the hands of others, complete brow presentation did actually exist. No such conversion is to be dreamt of when the head is fully fixed in the pelvis. Under these circumstances progress must be waited for and carefully watched, while the lying-in woman is laid on the side corresponding to the dorsum of the fœtus. Sometimes it is possible when the head has descended to or near to the pelvic outlet, to extract it with the forceps and to save the child. When however there is considerable delay in the middle and upper portions of the pelvis, when the brow is unfavourably placed with the chin backwards, the period for maintaining an expectant attitude soon finds its limits; in view of the dangers which threaten the mother owing to the mechanical disproportions, and considering how faint is the chance in such cases of preserving the child, it is good practice relatively early to proceed to its diminution and extraction.

The prognosis in brow presentations is therefore not favourable to the child. For the mother on the other hand under proper management, it is not so bad as is generally stated. Out of the 17 women in whom I have till now met with this presentation, only one died, and she had been exposed to a very difficult extraction after perforation; almost half the fœtuses died[1].

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[1] Since persistent brow presentations are rare, I add the following details in reference to my 17 cases. Eleven of the mothers were I.-paræ, three II.-p., one III.-p., one IV.-p., and one X.-p. Six of the seventeen had a *contracted pelvis*, either simply flattened, or flattened and generally contracted; the contraction was never extreme.

In one case both small *twins* entered the pelvis in the first brow position; in both this spontaneously changed into the first and fourth vertex positions, and both children were born without assistance and alive. In another case only the first twin showed a brow presentation; the head was large and perforation was required. On two

The *shape of the head and skull* in brow presentations is amongst the most striking, and may almost resemble that of a monster, especially when the head has been long in the pelvis, and the caput succedaneum is very distinct (fig. 54).

The caput succedaneum is placed on the forehead, which becomes extremely prominent and is very steep in relation to the face, while the vertex and occiput are flattened. The vault of the skull slopes down gradually behind like a roof, and sometimes actually shows a depression in the neighbourhood of the great fontanelle; the occiput looks pointed without being really

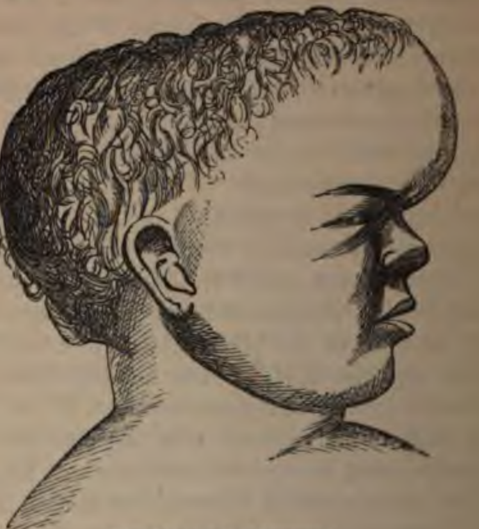

Fig. 54.—(After Swayne.)

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occasions labour was premature, coming on at the 28th and 30th weeks, the latter occurring in a moderately contracted pelvis; both children were born alive, the one whose mother's pelvis was contracted, being delivered with forceps. Out of the 18 children, 4 were extremely small.

In the remaining 14 labours occurring at the *full time*, I found that 5 times the pelvis was contracted; in two cases very distinct extra-median brow presentations occurred. Six of the children were born spontaneously, amongst them two still-born (one child was born alive although the pelvis was contracted); two were born alive with the help of the forceps, one dead after version and extraction (pelvis contracted); 5 were extracted after perforation (3 of the pelves were contracted); 8 therefore perished. One mother died, the child having been perforated. Thus including the premature and the twin fœtuses, out of the 18 children which were alive at the beginning of labour 9 were born spontaneously and 10 living. The numbers of first and second brow positions were equal.

elongated. The skull is therefore compressed in the "face-occiput" (mento-occipital) direction, elongated in the sub-occipito-frontal and mento-frontal (forming a triangle with one point at the forehead, fig. 55). This conformation is due to the fact that when the head is but partially extended, the occiput is compressed between the pelvis and the regions of the neck and shoulder, and a compensatory sagittal elongation of the skull can only take place in one direction, towards the forehead.

D. *Presentations of the Pelvic Extremity.*

§ 182. The *attitude of the fœtus* is the same in presentations of the pelvic extremity as in those of the vertex, except that in the former the thighs are more apt to abandon their flexed position upon the lower end of the trunk and to descend below it, leading, as already mentioned in § 162, to footling and knee presentations. These abnormal attitudes are easily accounted for by the readiness with which a living child alters the position of its limbs, by the frequency with which the lower segment of the uterus fails to adapt itself all round symmetrically to the presenting lower end of the fœtus, and by the action of gravity on the extremities, especially after the discharge of the amniotic fluid. So too may be explained the occasional detention of one extremity by some obstacle, while the other is extended or descends before the pelvis of the fœtus; or the detention of the leg either through the toes being hitched, or through its lying transversely and causing the knee to present. The breech presentation however is the commonest variety, particularly when the fœtus is mature (in my case-books I find that out of all the presentations of the pelvic extremity, 57 per cent. were breech presentations, and that the number of footling presentations was greatest in twin and premature labours; so that in the case of mature fœtuses the breech presentation is decidedly the most frequent); and it is not uncommon for the limbs which were lying next to the breech while the membranes were intact,

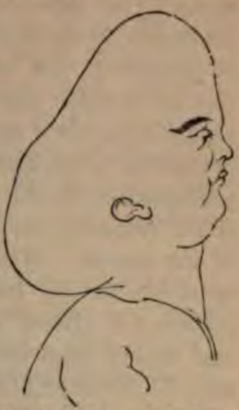
Fig. 55.—Shape of the head in a brow presentation.

to pass up again above it after the discharge of the liquor amnii, or rather to be pushed upwards and aside. These varieties of attitude have however no material influence over the mechanism of labour.

The *causes* of presentations of the pelvic extremity must mainly be sought for in a failure of those influences, described in §§ 108 and 109, which usually produce and maintain the *cephalic lie*. The most important are an unusually capacious uterine cavity, in comparison to the size of the fœtus, and lax uterine walls, which allow the fœtus much active and passive movement. Presentations of the pelvic extremity are therefore most common in multiparæ, in cases where the quantity of liquor amnii is unusually abundant, where there is more than one fœtus, where labour is premature, and where the fœtus is dead. The latter fact is especially remarkable, and although explicable by the instability of the fœtal lie in the earlier months of pregnancy, and by the absence of those active movements of the fœtus which play so important a share in bringing about the cephalic lie, yet it seems as if the ætiological connection between premature birth and death of the fœtus on the one hand and presentation of the pelvic extremity on the other were sometimes reversed, *i.e.* as if the latter were occasionally the cause of the former. What a large proportion of pelvic end births moreover is to be associated with plural and premature labours, is shown by the cases of labour collected by Hegar and myself from over a large area (*cf.* § 162). Out of 11,190 and 21,074=32,264 fœtuses, 910 were cases of plural and 659 of premature births; amongst the former, there occurred 227=25 per cent., amongst the latter 148=22·4 per cent. of presentations of the pelvic extremity, while the total proportion of pelvic end births only amounted to 2—2·5 per cent of the total births[1]. With these facts the records of my Maternity agree, for here I find nearly 27 and 23 per cent. of pelvic end presentations in twin and premature births respectively.

§ 183. A presentation of the pelvic extremity may be *diagnosed* by the procedure mentioned in § 163 for finding the head. If

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[1] The reason that the frequency of pelvic presentations appears in general to be greater here than that given in § 162 (1·59 per cent.), is due to the fact that in making the latter calculation the figures of Schwörer were used; but I was unable to use them for estimating the frequency of the pelvic presentations in plural and premature fœtuses from want of detail.

the latter is felt in the fundus (usually on one side), and is absent from the lower segment of the uterus, the diagnosis is clear. When the head cannot be confidently identified as such and the cervix is still closed, the following points are also characteristic: the lower segment of the uterus lies high up, and is not at all or but slightly expanded and distended, while the fœtal heart-sounds are heard at and above the level of the umbilicus. These points however, even if made out, do not settle the diagnosis, since they may also be found when the head (although presenting) lies high. When the *breech* can be felt through the vaginal fundus, it is recognised as a large, somewhat soft mass with an irregular outline, and having on one side the pointed coccyx and higher up the irregular sacrum, perhaps even an iliac bone, all of which are distinguishable from the smooth broad surface of the skull, and next to which small movable parts may be perceived, which easily slip away from the finger. When the os is patulous, the diagnosis is not difficult even with intact membranes, since it is possible to sweep the finger all round the presenting part and to follow its contour. The lower limbs may also as a rule be distinguished from the upper; "treading" movements are characteristic of the former, and may occasionally be perceived; they closely resemble those seen in new-born children.

After the discharge of the liquor amnii, the diagnosis is always easy, provided the lower end of the fœtus has come down, and that no sero-sanguineous swelling has as yet formed on the breech. But if such swelling is present and the limbs cannot be identified, the breech is apt to be confused with the face or even with the shoulder. This danger will always be avoided if the distinguishing features of each part of the body are borne in mind: thus in the case of the face, the opening of the mouth with the alveolar borders and the tongue; in the case of the breech, the anus with the bones of the coccyx, the nates, the iliac crests, the thighs pressed against the abdomen, with the fissure between them containing the sexual parts. The *foot* is distinguished from the hand by being longer and narrower, by its external convex and internal concave border, by its forming a more or less acute angle with the leg, by the malleoli belonging to the latter, and especially by the shorter and but little movable toes, of which the hallux is the longest; also by the extended position of the latter as compared with the long, movable, usually flexed fingers, and with the thumb, which is so characteristic of the hand and permits such free movements both as a whole and in its several phalanges. The *heel* may easily be mistaken for the elbow; the malleoli are however further removed from the heel than the condyles are from the olecranon. The *knee* may be recognised and distinguished from the elbow by its great size, by the patella, by the spine of the tibia which has a distinct edge on the side of the joint and to which the ligamentum patellæ proprium is attached, and by the inter-condylar fossa of the femur, while at the elbow-joint the olecranon lies between the two lateral elevations. The patella however is only of help in diagnosis, if the thigh is extended; when the knee is flexed, the patella is immovable and its outline is difficult to trace, since during flexion it disappears almost completely into the hollow of the joint.

§ 184. Presentations of the pelvic extremity are, as already mentioned, divided into two positions, as was done with those of the head, according as the *dorsum of the fœtus is directed to the left or to the right* (1st and 2nd pelvic positions); subdivisions may be made, according as the dorsum is directed more forwards or backwards; the forward direction is the commonest.

Labour progresses according to the same principles as were detailed under the general mechanism. After the discharge of the amniotic fluid, the body of the fœtus is more compressed than before, the flexion of the head is increased, the chin is more firmly pressed against the chest, the thighs are forced against the abdomen. The fœtal pelvis engages with its transverse diameter in one of the oblique diameters of the pelvis, only rarely in the transverse or the antero-posterior. In any case after passing through the brim, its biniliac diameter is placed in one of the obliques, the sacrum looks towards the anterior wall of the pelvis, and (except in the circumstances in which in vertex presentations also a bilateral obliquity is met with [Nægele's]) both hips lie in the same parallel plane. If the anterior often seems to lie lower than the posterior, this is due to the anterior half of the pelvis of the mother being less deep than the posterior, and to the inclination of her pelvis to the couch on which she lies. In this oblique position the breech advances to near the pelvic outlet with its sacrum low. But here as a result of the resistance met with (and which in cranial positions causes the rotation round the longitudinal fœtal axis), the breech rotates in such a manner that the biniliac diameter approaches more and more to the sagittal median plane, and finally comes to lie in the sagittal diameter of the outlet, one hip behind and beneath the symphysis, the other at the lower end of the posterior pelvic wall and on the perinæum, the sacrum looking towards one of the ischial tuberosities. Since however the shoulders retain their oblique position during this movement, the lower part of the trunk must be somewhat twisted. The buttock which is directed forwards, now appears in the vulva, and its great trochanter is pressed against the lower edge of the symphysis. The posterior hip is pressed against and distends the perinæum, since the expelling force continues to act in the axis of the brim. The resistance of the perinæum forces this hip forwards, and compels it to rotate towards and into the genital fissure, describing a curve as it does so, whose centre

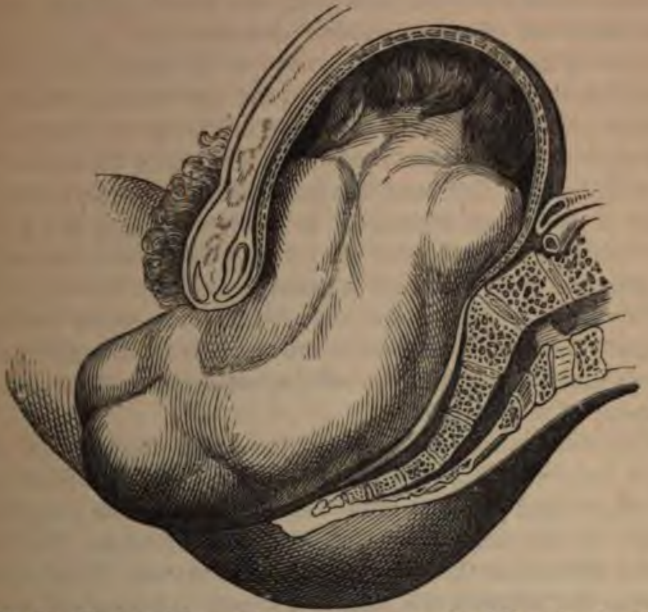

Fig. 56.—The lateral flexure of the trunk accompanying delivery in a breech presentation. (After Hodge.)

lies in the hip which is pressed against the anterior pelvic wall. As soon as the posterior vulvar commissure has slid back over the hindmost hip, the anterior also makes its exit beneath the pubic arch, and the breech is delivered. This is immediately followed by a retrograde rotation (corresponding to the twisting of the trunk which has been mentioned) round the longitudinal fœtal axis, *i.e.* the transverse fœtal diameter returns to the oblique diameter of the pelvic canal, the sacrum and the dorsum again turn (from looking sideways) to the front.

Since, from what has been said, the breech emerges square with the plane of the vulva, and therefore rises up in a curve in front of the symphysis, the body of the fœtus must form a curve, which is strongly concave on the side turned towards the anterior pelvic wall, since those parts of the trunk which are in and above the pelvic brim continue to advance in the axis of the latter (fig. 56). This bend disappears when the lower half of the trunk is completely delivered. It is more marked, the greater the resistance of the floor of the pelvis. The rotation round the longitudinal fœtal axis also is mainly caused by this resistance, and by the size of the lower end of the trunk; when the latter is small, the perinæum narrow and unresisting, the exit of the breech may take place in the oblique, and even in the transverse diameter of the pelvis.

With the further delivery of the trunk, the thighs of the child which had been flexed on the abdomen are set free; next come the elbows, and then the arms and the thorax, this order being caused by the contractions of the uterus pressing the arms (which are bent at the elbows) against the thorax. The shoulders traverse the pelvis in the oblique diameter and pass out of it in the direct; they advance throughout (just as did the breech) at right angles to the parallel pelvic planes lying one below the other, so that while the anterior shoulder is pressed against the symphysis, the posterior sweeps over the perinæum; the former not being fully liberated, till the perinæum has glided back over the latter. This however is only true (as in the case of the breech), where there is a sufficient resistance at the pelvic outlet and floor. Just as during the exit of the breech the trunk was somewhat twisted, so is the neck now, since the head has retained its oblique position. The twisting disappears by the shoulders, when delivered, resuming the oblique position.

While the head with the occiput directed forwards passes into and through the pelvis in the oblique diameter, the expelling force, which is now entirely due to the abdominal muscles, causes it to be even more flexed than it was; the chin comes to be directed straight downwards, the point of the occiput lies against the fundus uteri, and the mento-occipital diameter corresponds nearly with the pelvic axis. As in head-first presentations the occiput is forced to the front either above or in the pelvic outlet, so here a similar movement occurs when the head emerges last. In consequence of this rotation round the longitudinal fœtal axis, the occiput comes to lie behind the symphysis, the forehead in the sacral concavity; at the outlet the base of the former lies under the pubic arch, the great fontanelle is close to the coccyx, the chin rests on the perinæum, the sub-occipito-parietal diameter runs in the direct, and the biparietal in the transverse diameter of the outlet. The abdominal pressure now causes the forehead to descend, and the resistance of the pelvic floor drives it forwards and yet more against the chest. The chin appears at the anterior edge of the perinæum, and the head comes into view by rotating round the base of the occiput which is resting below the pubic arch.

If, as occasionally happens, the head has engaged in the brim with its sagittal diameter in the transverse of the pelvis, it is subjected in the cavity of the latter to the usual rotation into the oblique, and then into the direct diameter.

The signs of the *first breech position* are accordingly the following: at the brim the sacrum and the coccyx are found turned to the left, either straight to the side, or towards the left ilio-sacral synchondrosis, or (and this is commonest) to a point above the left acetabulum; but in any case the breech, as it advances, is driven forwards and to the left. The left hip is then directed forwards and to the right, and is the one felt most distinctly, the biniliac diameter lies in the second oblique of the pelvis. During its exit the left hip turns from the right side to below the pubic arch and is the first to appear, the sacrum looks towards the left tuber ischii, the right hip sweeps forwards and upwards over the perinæum, and after it the left one is also expelled. With the subsequent exit of the trunk, the hips again rotate into the left oblique diameter, and the back of the fœtus looks towards the anterior surface of the left thigh of the mother.

The shoulders traverse the pelvis like the breech, the left turns towards the symphysis and comes to lie beneath it, the right sweeps over the perinæum, the dorsum looking straight to the side. After its exit, the latter again turns towards the anterior surface of the left thigh of the mother, the head enters the pelvis in the first oblique diameter, the occiput moves behind the symphysis, the neck lies below the latter, and the head is born as above described.

In the *second breech position*, the right buttock is placed in front, the dorsum looks to the right, the hips lie in the first oblique diameter. The further mechanism may be deduced from that of the first breech position, if "right" is always substituted for "left."

§ 185. The *sero-sanguineous swelling* of labour is situated on the presenting, *i.e.* the anterior, buttock. It varies in extent according to the length of time occupied by the breech in passing through and out of the pelvis, and may amount to a simple sometimes scarcely noticeable œdema, or to a large bluish-black swelling due to extravasated blood. The generative parts are as a rule affected, especially the scrotum, which may come to resemble a tense, large, deeply coloured bladder. The head has a characteristic round brachy-cephalic shape, a shape which is all the more striking from the absence of a caput succedaneum. The formation of this "*round head*" depends on the fact that while the remaining periphery of the skull is subjected to the pressure of the parturient canal, the region of the vertex escapes this pressure; and inasmuch as the occipital, parietal and frontal bones are forced upon the cranial cavity to an equal degree (the parietal bones owing to their greater mobility may glide over the other bones), the compressed cranial contents react upon the vertex in such a way that the vertical diameter of the originally oval skull is increased, while the direct and the transverse are diminished. Equitations at the sutures are almost never seen where the pelvis is normal; when present, they usually last so short a time that they disappear immediately on delivery.

§ 186. *Deviations from the usual mechanism: a. If the dorsum is directed backwards*, it is not rare for the breech to pass through the pelvis with the sacrum looking towards one of the ilio-sacral synchondroses, and with the abdominal surface looking forwards (so-called 3*rd and* 4*th breech positions*). But at the outlet the hips rotate into the direct diameter, and after the birth of the breech, the trunk continues to rotate in the same direction, so that the dorsum moves forwards and the child is born in the way described above. Sometimes however after the exit of the hips in the direct diameter, the dorsum again turns to the rear, and its forward rotation is deferred till the birth of the arms, or even till that of the shoulders, whose bin-acromial diameter also emerges from the pelvis in the direct diameter. But if the change of position does not take place even at that stage, if the dorsum remains obstinately directed backwards, the head advances into the pelvis, with the face looking forwards and lying in one of the oblique diameters. When the attitude is normal, the chin is pressed against the chest and near to the middle line of the pelvis, the forehead lies against the floor of one or other acetabulum, the neck is directed towards the opposite sacro-iliac joint, and the occiput looks upwards.

1. Under the influence of the oblique lateral pelvic surfaces, and especially of the ischial spines, the occiput (as the head descends) even now very frequently rotates forwards, and the head makes its exit in the usual way. 2. The occiput however may remain directed backwards. It then moves into the hollow of the sacrum, the head is still more flexed, the face descends below the anterior pelvic wall, the forehead becomes fixed under the pubic arch, the neck lies against the posterior commissure. If now the pelvic floor and the coccyx do not offer too great a resistance, the forehead descends more and more in front, and finally the occiput sweeps out over the perinæum, while this is forced backwards. But when the pelvic floor and coccyx present great obstruction, the strong flexion of the head which is necessary for this mode of exit becomes impossible, and the head does not progress. 3. If for any reason the chin has become separated from the chest during the passage of the head into and through the pelvis, it may easily remain caught against or even above the anterior or lateral pelvic wall, the occiput being forced against he nape. The chin meanwhile ascends, and the head assumes he same attitude as in a face presentation; its base corresponds with the pelvic planes, the mento-occipital diameter passing hrough one of the oblique diameters. In this position sponaneous delivery is impossible, except with a very small and yielding head.

b. The *hips enter the pelvis transversely*, the dorsum looking directly forwards or backwards (the former is more frequent). The sagittal diameter of the trunk then corresponds to that of the pelvis, the biniliac to the transverse of the latter. When the sacrum has descended low, the breech moves down to the outlet, and at this point, if there is sufficient resistance, rotates round the longitudinal axis, so as to bring the hips into the antero-posterior diameter in which they emerge, as above described. Since during this movement the trunk must rotate through the quarter of a circle, and the lumbar part of the vertebral column offers great opposition to such torsion, the shoulders also rotate and enter the pelvic canal in the oblique diameter; their delivery and that of the head then take place in the usual way. It is very rare for the head to enter in the sagittal direction; the forehead, nape and occiput are hindered from taking up the position by the projecting lower lumbar vertebræ and by the promontory, which compel the head to enter obliquely.

c. Super-rotations are not uncommon in presentations of the pelvic extremity, both when the dorsum looks forwards, in which case it rotates from the first into the second position and *vice versa*, and when it looks backwards; indeed the trunk and the head may under such circumstances rotate through a semi-circle, so that the abdominal surface or the face, which were at first directed forwards, may reach the posterior terminal end of the oblique diameter at whose anterior end they were previously lying.

d. Footling presentations, as already observed, do not alter the mechanism, except that rotation round the longitudinal axis is not uncommonly delayed until after the exit of the breech, since the latter, diminished in size by the extremities being stretched down, does not always meet at the pelvic outlet and floor with the resistance which is necessary to bring about the rotation. Super-rotations occur here also, especially in incomplete footling presentations when the prolapsed limb is the posterior one; for since the buttock belonging to the thigh which is thrown upwards, is apt to be caught above the anterior pelvic wall, it is the side on which the limb is prolapsed, that rotates forwards.

§ 187. The *prognosis* of presentations of the pelvic extremity is not less favourable than that of vertex presentations as regards

e mother, so long as no complications arise which call for
erative interference; it is only primiparæ that run somewhat
ore risk, owing to the greater resistance of their pelvic floor,
d to its not being satisfactorily stretched by the yielding first-
ing trunk, and owing therefore to the frequent manual assist-
ce that is required, and to the bruising of the lower part of the
rturient canal caused by the latter. But as regards the *child*,
esentations of the pelvic extremity are decidedly more dangerous
an those of the vertex. The danger arises through the umbilical
rd being compressed between the body of the child and the
rturient canal, when the breech is born, and through the uterine
vity diminishing in size behind the gradually advancing child,
ich diminution leads to detachment of the placenta, and thus
a disturbance and interruption of the fœtal interchange of
ses, and therefore to asphyxia. The same occurrence may of
urse accompany head presentations; but in these the expulsion
the trunk rapidly follows that of the head, and the want of
eath which has set in, can therefore be rapidly satisfied. This
not so with an after-coming head, since the difficulties of
bour are often only beginning when the child experiences a
soin de respirer, and since it is just the last stages that are so
sily delayed. Hence it is important that the breech be born
slowly as possible, in order that the parturient canal may be
equately dilated and prepared so as to allow the after-coming
ink and especially the head to traverse it rapidly. In addition
the danger caused by the delay in the exit of the upper half of
e body, there are others associated with premature rupture of
e membranes, prolapse of the umbilical cord and coiling of the
me round fœtal parts, dangers whose advent cannot, for obvious
asons, always be prevented.

Speaking generally therefore, the condition of the parturient
nal as regards laxity and roominess, the size and attitude of
e child and the power of the expelling forces determine the
ognosis. If these conditions are at all unfavourable, inter-
ence will be necessary, and dangers associated with the
traction are not infrequently added to those arising directly
t of the presentation.

Of the separate positions, that in which the dorsum looks
ckwards is the least favourable, since it is connected with
sturbances in the mechanism, and especially with displace-

ment of the upper extremities, and then, as also where the head enters the pelvis with the face looking forwards, artificial assistance is frequently required. Footling presentations too as a general rule make the prognosis less favourable for the child, since the membranes are apt to rupture prematurely in such cases, and the umbilical cord to prolapse, and since the breech, diminished in size by the extension of the thighs, can traverse the parturient passages (especially the cervix) before complete dilatation has occurred; during the additional dilatation of the latter which is necessary for the passage of the shoulders and of the head, so much time is often consumed that the child succumbs to asphyxia. For the same reason an incomplete footling presentation is more favourable than the complete; the breech being larger when one thigh is flexed on the abdomen, advances more slowly than when both feet present. On the other hand a prolapsed foot gives us a "handle", so to speak, for any extraction that may be necessary.

§ 188. From the previous description it will be evident that the *management* of a labour in which the pelvic extremity presents, requires closer attention than do the ordinary vertex presentations. In the first place, remembering the great risk to the child (over 20 per cent. are still-born), it is desirable when the practitioner is summoned sufficiently early, *i.e.* at the end of pregnancy or at the beginning of labour, to make an attempt by means of external manipulations (as described in the chapter on "External Version") to convert the breech into a vertex presentation, and to render the latter permanent. The conversion will often be successful, owing to the instability of presentations of the pelvic extremity, but is rarely persistent. When the breech presentation cannot be so converted, the conduct of the accoucheur must be regulated by the fact that these labours as a rule pass off most favourably, where there is least interference. His first care must be to preserve the integrity of the ovum as long as possible, since a delay in the period of dilatation, while the membranes are intact, does no harm, and considerably expedites the rapid and uninterrupted progress of the period of expulsion. The parturient woman must therefore occupy the recumbent posture even at the beginning of labour, and should lie on the side which corresponds to the dorsum of the fœtus; this favours the normal rotation round the longitudinal axis, and bearing down efforts are not so effectual in the lateral as in the dorsal posture. Nothing must now be done to encourage pains; every unnecessary examination is to be avoided, neither rectum or bladder must be evacuated in the squatting posture, nor must any violent straining efforts be made, for fear of imperilling the safety of the bag of membranes. Even when the membranes have burst, and when an examination must at once be made in order to obtain an accurate knowledge of the position and attitude of the fœtus, and especially of the limbs and umbilical cord, the conduct of the accoucheur must mainly be a negative one, till the hips pass through the vulva. At this stage however the woman may bear down vigorously during the pains, although the presenting part must on no account be pulled or rotated. I cannot caution too distinctly against such interference; during the whole progress of labour it is prohibited, for nothing is more likely than such manipulations to disturb the normal rotation of the body, to cause the arms to be separated from the thorax and to be thrown up by the side of the head, to lead to premature descent of the occiput, and thus to prevent the necessary flexion of the latter. However great the temptation to hasten matters may be, when labour progresses slowly, all interference is strictly forbidden, except where there are special indications. Nor is it any more permissible to bring down the thighs prematurely in the case of breech presentations, since by so doing the principal safeguard of the pelvic presentation is thrown away. It is only in the case of primiparæ, when the pelvic floor is very broad and resisting and the vulvar opening small, that it may occasionally be advisable (especially when the breech appears to be large and in view of the extraction which under such circumstances will often become necessary), at an early period, *i.e.* while the breech is still high (when the latter is low, it can no longer be done through want of room), to bring down the anterior thigh and thus to produce an incomplete footling presentation. This foot in case of necessity affords a convenient handle with which to extract the breech through the vulva, a matter which under the given conditions may be very difficult.

When the hips are about to pass out, the lying-in woman should be so placed that assistance can be rendered at any moment that it should be called for. Her pelvis should be raised by means of pillows, unless the practitioner prefers to deliver her in the lateral position. The fœtal pulse must be very closely watched by means of auscultation during the whole of this period, since the fœtal interchange of gases might at any time be interrupted by compression of the umbilical cord between the thighs, or between the thorax and the parturient canal, and such an interruption makes it necessary for delivery to be accelerated. It is always important to support the perinæum during the exit of the hips, not only for the sake of its safety, but because pressure exerted on the posterior portion of the perinæum in a forward direction, considerably assists the exit of the hips, by favouring the lateral curvature of the lower end of the trunk. When this exit has taken place, it is well (to avoid endangering the perinæum) not to permit the extremities to slip out too suddenly, although at the same time the rotation of the dorsum must not be hindered by too vigorous a pressure. The portion of the child that has been born, should be wrapped in a warm cloth, and the trunk be raised a little in front of the mother, since this is its natural relation; the broad hepatic region however must not be much pressed upon. The umbilical cord may now be felt for; if very tense, it should be relaxed by gentle pulling at the placental end. If it runs from the navel between the thighs over the back to the placenta (if the child rides on its cord), the part which crosses the back may be drawn down; the hindmost thigh should be flexed at the knee, and the cord slipped over it. It can scarcely ever be necessary to ligature and cut it owing to excessive tension. From this time onwards the pulsation of the cord keeps us informed of the condition of the child, and it must be closely watched. Should it show important interference with the placental interchange of gases, the delivery must be immediately completed.

While the trunk and still more while the head is passing out, the lying-in woman must bear down energetically during the pains; one hand of the accoucheur should support the body of the child, the other exerts a gradually increasing downward pressure on the fundus uteri, and as far as possible from the fœtal dorsal side. In this way not only is the progress of the child favoured, but the flexion necessary for the natural exit of shoulders and head is assisted and insured. During the expulsion of the shoulders, the trunk must be raised and strongly bent to one side in the same way as was done in the case of the breech, and a forward pressure should be exerted on the posterior shoulder through the perinæum. When the shoulders are delivered, the head must rapidly follow. This is favoured by an assistant pressing forcibly on the fundus, and as soon as the face lies in front of the coccyx, by raising the trunk well up in front of the symphysis; by this means the occiput rises up behind the pubes and moves towards the middle of the pelvic cavity, the chin approaching the middle of the pelvic outlet. Meanwhile two fingers should be laid on the perinæum in front of the coccyx, not only to protect it, but at the same time to push the forehead forwards and the chin into the vulva. A forward pressure exerted by one or two fingers on the forehead or vertex *per rectum* is occasionally a useful procedure, a true imitation of the normal mechanism of rapidly accomplishing the delivery of the head from the vulva, and at the same time of preserving the perinæum.

In footling and knee presentations the desirability of preserving the bag of membranes intact as long as possible, is even greater than in ordinary breech presentations; the longer the period of dilatation lasts in these cases, the more slowly the limbs and breech pass through the pelvis, the better; they must never be brought down without imperative reasons. Now and again however an unfavourable, and especially a transverse position of the leg within the parturient canal, may call for a manual rectification.

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3. *The Management of Labour.*

§ 189. Thousands of women are successfully confined without any skilled assistance whatever, and it is questionable whether the help which many of our midwives are able to render, always erves the name. It might seem therefore as if assistance e superfluous during so physiological an event as a labour is, en it runs its usual course, but it must not be forgotten on other hand that the process which has been normal up to a tain point, may at any moment become pathological, that ortant irregularities may come on unnoticed, whose effect is ealed either at once or at a later time; moreover that an iscreet conduct of the parturient woman is frequently a cause danger, and that with our highly civilised conditions of life herself almost always demands an alleviation of her troubles, her new-born child the care suitable to it.

he "management of labour" therefore denotes the use of various means we possess of alleviating the troubles and culties of labour, and deals with the importance of watching r its progress, of guarding against abnormalities, at all events ecognising them early, and of preventing infection.

t will, I suppose, be generally admitted that in order to fulfil se requirements, a thorough knowledge of midwifery is neces- r, certainly more than an average midwife learns and under- ds, and it is therefore becoming more and more the custom, ny rate in large towns, to call medical men into the lying-in mber; for obvious reasons however this will never be universal. accoucheur must be familiar with all matters and arrange- ts required for a normal labour, and when once he has en charge, the nurse or midwife must act entirely under his ctions.

190. The accoucheur, when summoned to a woman in our, should not delay to obey the call, even when he is rmed that all is right; otherwise he might miss the best ortunity for rendering any necessary assistance. He must e with him the requisite *armamentarium*, and never trust to instruments of the midwife who may be present, since he not be sure that they are clean and therefore safe. Unless he ws that the lying-in woman has an irrigator, he should take h him a compact well acting syringe (preferably an ordinary gical syringe), to which a metal flexible tube can be affixed, a le silver and an elastic catheter, a good pair of scissors, a stetho- pe, a dressing case and a hypodermic syringe with a suitable tion of morphia. If the dwelling of the lying-in woman is at reat distance from his own, or if he is summoned during the

night, he will do well to take with him forceps and a noose. A more complete armamentarium is only wanted when he is summoned miles away, in which case he should also provide himself with ergot in powder or solution, with tincture of opium and chloroform. *All his instruments must be perfectly clean*, and if they have already been used for other individuals, must be *thoroughly disinfected.* This is especially true of elastic tubes and such other instruments as are more difficult to rid of matters liable to cause infection, than are metallic ones. If the accoucheur shortly before being summoned, has been in contact with infectious disease or septic matters, it is his duty either to decline to conduct the labour, stating the reason, or at least previously to disinfect himself and his clothes in the most thorough and conscientious manner possible. With our present knowledge of the mode of origin of puerperal fever, it is an inexcusable want of conscientiousness to take charge of a labour without such precautions.

On reaching the lying-in woman, he should not introduce himself abruptly, but begin by obtaining all necessary information from the surroundings. He may then question the woman herself, especially in reference to her present pregnancy, and to any earlier confinements &c.; when this has been done a vaginal examination should be made.

First of all however *the genital canal of the lying-in woman, as well as the arm that is about to examine it*, must be thoroughly disinfected. Puerperal infection is almost invariably conveyed during labour, and not only by the introduction by the attendant of septic matters from without, but frequently by the natural contents of the tract itself. In the neighbourhood of and within the generative organs there are almost always matters in a state of decomposition, which the examining fingers are liable to convey to the cervix uteri, or inoculate into any superficial abrasions, however slight, which are already present or produced by the exploration. Just as in operations carried out antiseptically on the surface of the body, the area of operation must be disinfected, so, if the labour is really to be conducted antiseptically, must the generative canal also be, as far as possible. *The necessity for continuing this prophylactic disinfection of the genitals throughout the entire labour and especially during the period of dilatation, cannot be too strongly insisted upon*, especially as the directions for our midwives say nothing about it, and these women therefore, together with so many practitioners, think that the antiseptic requirements have been sufficiently carried out by the disinfection of their hands and instruments. If the lying-in woman in spite of this falls ill after her confinement, all confidence in the importance of personal disinfection is lost.

Before the examination therefore the external generative organs of the lying-in woman and their neighbouring parts over a considerable area, must be thoroughly washed with soap and then with carbolised water, clean linen being used, not sponges; the vagina must then be thoroughly irrigated with tepid 2 per cent. carbolic acid water. The accoucheur should throw off his coat, slipping any further coverings of his arms up to the shoulder, and then wash and scrub his arm with soap and afterwards with carbolic water, brushing especially the fingers and nails as carefully as possible with a strong solution of carbolic. Septic matter is specially apt to cling to the nails, and the mere anointing of the finger with carbolic oil, whether 2 or 10 per cent., is therefore not sufficient. The fats used for anointing the finger, must also be carbolised, since such substances may contain septic material.

When the examination is completed, the vagina must again be washed out with tepid carbolic water. Inasmuch as air is necessarily conducted into the vagina during the examination, and cannot be disinfected as is done in surgical operations and may excite decomposition in the genital canal, *that air must be removed by irrigation, which will at the same time disinfect any that remains behind.* Previous to each subsequent examination, the hands must be again disinfected, even though they have not been again soiled, and after each future examination the *vagina* also *must* for the above-mentioned reason *be again irrigated with about 2 per cent. carbolic water.* This proceeding takes time, and may often be annoying to the lying-in woman, but it is unavoidable, and the health of the woman will be our reward. The chief duty of the accoucheur is to shield the lying-in woman from dangers, and what greater danger can threaten her than that of septic infection!

§ 191. The examination should be made as complete and accurate as it can be, so as not to need early repetition, and so as to afford the least opportunity possible for the admission of air

upon the lie, position, life and condition of the fœtus
upon the shape of the pelvis, and the exact relation of t
parts to it—questions which cannot be answered by a su
examination, but which must be answered, if we wish t
clear insight into the progress of labour, and to remain n
the situation. The first exploration should always be un
in an interval between two pains, since during a pain th
is too sensitive and restless. It is well however to pr
during a pain, in order to obtain as clear an idea as po
the strength and efficiency of the expelling forces; care
taken not to burst a still intact bag of membranes prema

A prognosis may be made in regard to the progr
duration of the labour, according to the results of the e
tion. It is usually possible to speak definitely in refe
the first point, but impossible as regards the latter. T
titioner should therefore be very reticent in offering an
as to the probable duration, and place the termination so
further off than seems likely, so as not to destroy the co
which it is very desirable that he should possess, by a p
which does not prove true, and not afterwards to be both
numerous questions and complaints. He may com
patient during severe pains by reminding her of the gr
gress that is being made.

§ 192. The *rectum should be emptied* by a simple
unless this has been already done. The *bladder* dur
whole course of labour demands especial attention, an

urselves with what we find, although light and fresh air ways be insisted on, as well as the departure, as far as le, of persons who have no direct business in the room. ed should be easy of approach on both sides, and not too a strong and smooth mattress is the best. To prevent the from being soaked through, a piece of macintosh cloth enough to protect the sides of the bed, may be spread out ts middle; the sheet covers everything. Feather beds l be avoided; woollen things and quilts are better. There need of any special contrivance for fixing the extremities, here it is desired, a pillow for the feet or for supporting the and the sacrum may be allowed. The clothing should t of the ordinary night costume, without any tight portions; ngs should not be taken off. During the last stage of the when the lying-in woman remains permanently on her he night-dress and jacket should be tucked up above the so that they may remain clean to the end of labour, and eed changing immediately after it. Food and drink may owed *ad libitum*, provided that not too much at a time is nor anything stimulating.

re are no special directions for the lying-in woman to *during the period of dilatation*. So long as her condition, ally the pains and forcing sensations permit, she may be bed and walk about; indeed this is preferable to lying too soon, since the weight of the fœtus itself is better d for dilating the cervix; she must however as far as le avoid bearing down. The presence of an attendant, specially of a medical man, is unnecessary during this ; but the results of the examination together with a calculation must decide whether, how far, and for how e may go away. When the lying-in woman is very ble and sensitive to pain, it is a good plan to give her a aneous injection of ·015 grm. (¼ gr.) of morphia, this ve her friends and her attendant some rest. The continued ce of the latter during this period is further undesirable, reason that it leads to a repeated internal examination, is is now to be avoided as superfluous and prejudicial. the time for the rupture of the membranes is near at the lying-in woman should take to her bed, in order on it it the discharge of the amniotic fluid. When this has amnii has been discharged before the complete dilat the cervix uteri, the woman must in any case get into b that dilatation is complete.

§ 193. The *posture of the woman* is not a matter importance, unless the resistance of the parturient unusually great and a cause of delay; she may be al lie as she likes. Practically however the choice rests the lateral and dorsal postures, other positions only ca consideration in special cases. As a general rule she sl on her side, from the time when the presenting part is the pelvis till it reaches the floor of the pelvis, since posture the expelling forces act most nearly in a line axis of the inlet, and are thus perpendicular to the parallel planes of the pelvic cavity. But for this pur pelvis must be sufficiently fixed, and this is best accompl well bending the upper part of the body and the lower ext The lying-in woman therefore during the pains lies with inclined towards the chest, the trunk bent towards the kn latter adducted towards the abdomen; and since the fee *point d'appui* and find one against the foot of the bed, th is most conveniently placed close to it. It is not nec separate the knees by laying a pillow between them, till is about to make its exit; her hands may cling to a pill those of the attendant. During the interval between th the woman may modify this constrained attitude at will the uterus so frequently deviates to the right, the lef posture is generally most appropriate. For the exit of t xis of the uterus to correspond as far as possible with the axis f each part of the pelvis. As already observed, this is not sually necessary during the passage through the brim and the avity, but if it were desired in a special case to bring the brim f the pelvis to lie horizontally, the lying-in woman should be laced with her back well raised, while she herself is half-way etween sitting and lying. During the exit of the child, the pposite is necessary, the lumbar vertebral column should form s obtuse an angle as possible with the pelvic brim; it should herefore be greatly extended, so that the uterus may lie close pon it, and its axis fall on the anterior margin of the outlet. This is approximately effected by well raising the lumbar and acral regions (either by pillows or by a third person lifting he woman), while at the same time the uterus is pressed against he vertebral column, and is prevented from lying too far orward (the abdominal belt recommended in England is very seful from this point of view). The expelling force may be rought to act perpendicularly to the plane of the outlet and f the vulva, by placing the lying-in woman in such a position hat she bends over forwards, by allowing her to raise herself nd to support the upper part of the body with her hands against he foot of the bed; in this posture also the action of gravity omes into full play during the exit. Such a constrained and npleasant posture however is only resorted to, when there is pecial difficulty and delay; in ordinary cases it is unnecessary. Still less so is the kneeling, cowering position out of bed.

During the *period of expulsion*, the woman may assist the ains by bearing down, but she must only do so while they last; ndeed at this period of labour, she will bear down of her own ccord, and it is better not to say too much about it, lest she do o at the wrong moment. She should not be allowed to throw ack her head or grind her teeth; a napkin may, if necessary, be aid between the latter. Unseemly screaming is mischievous, and may often be at once checked by a few decided words. If the bdominal walls are flaccid, the muscular system sluggish and he uterus very movable, a firm bandage may be useful in giving upport. There is nothing further to be done at present, except to watch and to encourage. Vaginal examinations may be made more frequently and with less hesitation than during the first period, since the cervix which is so liable to be inoculated, is

now beyond reach of the finger. When the fœtus
slowly, its heart-beat must be closely watched. Pres
be made from above, by placing two hands flat upon the
and often contributes materially to the acceleration of l
bringing on pains and assisting the abdominal pressure,
frequently happens during the last moments, progress i

§ 194. When the head reaches the vulvar aperture, an
the pelvic floor before it during the pains, the *perinæum*
protected from laceration. The so-called "*support*"
perinæum, as still generally practised, and consisting r
pressing it against the advancing part, does not afford
tection; the only effectual way is to watch for, and ob
causes of laceration. In rare cases the size of the advan
of the fœtus is out of proportion to the width of th
ring and to the extensibility of the perinæum; but as a
causes lie on the one hand in the head pressing too muc
the posterior part of the perinæum, *i.e.* its extension is
and delayed, on the other hand in the head descendin
with too much violence, and leading to more rapid a dist
the pelvic floor than its elasticity can bear. *The per*
therefore to be protected by facilitating the extension of
round the symphysis (*sc. neck*), *as a centre of rotation, a*
same time by allowing the head to emerge so slowly,
elasticity of the perinæum may be fully developed an
anterior portion can retract over the head. It will depe
conditions of the individual case, which of the two indi
the chief one to be attended to—whether to promote t
sion of, or to delay the head. For carrying them out b
are generally required; one of them lies on the perinæ
to exert the desired counter-pressure, the other acts on
itself. Each hand however may fulfil both indications
the perinæum may detain the part which is passing out
it forwards, the other hand can also do so while contr
head. It is better however when the two hands co-ope
each other; and it is a good plan to bring the force l
the extension and to retardation, to bear mainly on
itself (since strong pressure on the perinæum is pr
and to allow the hand which is lying on the perinæu
main to simply watch its behaviour, and if necessary
it off from the advancing head. Sometimes the exte

elevation of the head out of the vulva are best managed *per rectum*, by inserting two fingers into the latter, and pressing on the forehead and afterwards on the edges of the orbits; the desired end is thus reached more directly than through the thick perinæum. But in the majority of cases this old mode of procedure (recently again recommended under a new name) is unnecessary, and, owing to the constant risk of abrading the mucous membrane of the rectum, should not be resorted to, except under special circumstances. These manœuvres for protecting the perinæum are as a rule only to be used during the pains; only under certain conditions, as when the perinæum is very thin and fragile, is the head to be raised out of the vulvar fissure during the interval between the pains, while the other hand pulls back the perinæum over it. The behaviour of the latter during the pains will indicate whether the woman should be forbidden or encouraged to bear down during the passage of the head.

It is possible to supervise the perinæum both in the *lateral* and in the dorsal *posture; but the former is to be preferred* from the possibility of directly observing it, and at the same time of fixing the pelvis more satisfactorily. The accoucheur sits behind the strongly flexed woman, who should lie with her hips close to the edge of the bed, and lays one hand (which should be bare, so as to keep him informed by direct tactile sensations of the state of the head and pelvic floor during the whole period of exit) flat on the perinæum, the thumb on the upper, the fingers on the lower labium; the other hand is carried above the upper thigh to between the two thighs, and placed on the advancing occiput while the arm steadies the woman. In the *dorsal posture* the pelvis must be somewhat raised; the accoucheur sits by the side of the woman, and holds one fore-arm parallel with the axis of her body between her slightly abducted and flexed thighs, while his hand rests on the perinæum in such a way that the palm lies on the posterior commissure of the vulva, and the fingers next to the anus; the other hand seizes the head from above. The emerging part is now delivered according to the principles that have been already stated; the fingers lying on the head may, as necessity arises, raise it up or hold it back during a pain, or strip off the tense edges of the labia and the posterior commissure of the vulva. The hand lying on the perinæum must closely follow the head; especially while the anterior portion of the perinæum is being retracted over the vertex, forehead and face, must the perinæum be carefully watched and held evenly against the head, so that retraction shall take place slowly, for it is now that laceration is most apt to occur.

It must however not be forgotten that under certain conditions the attempt to preserve the perinæum entire is a hopeless task, *e.g.* as already observed, with a vulvar fissure which is very small, or out of all proportion to the size of the head and its advancing diameters (face or occipito-posterior presentations); so also sometimes with a non-elastic, fragile, very thin perinæum. In such cases it is better to *anticipate the tear by making an incision* with scissors or a blunt-pointed bistoury into the vagina, passing on one side of the raphe (or frænulum) ca. 1·5 cm. (·5 in.) from it in the direction of the tuber ischii, and through the tense edge of skin and the muscular ring of the constrictor vaginæ. It is not necessary entirely to avoid the skin in doing so, since it will in any case give way during the exit of the head, and since the requisite stitch can be more easily inserted from the cutaneous surface than from the vaginal mucous membrane. As a rule an incision 2 cm. (·75 in.) long suffices; after making it, the practitioner must be immediately prepared to hold back the head, which has been released and which can now rapidly advance, lest a tear be superadded to the incision; the incision should therefore not be made at the acme of a pain. On the completion of the labour, the edges of the tear should be united with carbolised silk or clean catgut. If however the necessary precautions for preserving the perinæum are attended to, an incision will be less rarely called for, and in view of the fact that it may become a centre of infection, should only be made when absolutely necessary; the wound must be kept as aseptic as possible, the edges being accurately brought together. Occasionally the perinæum gives way, even when an incision has been made.

§ 195. As soon as the head is born, it is well to feel with the fingers of the free hand whether the anterior portion of the perinæum is clinging to the mouth and chin, and, if it is, to push it back. The *umbilical cord* should next be looked to, and if *twisted round the neck*, the loop should be loosened so that the trunk can slip through it; if very wide, it may be slipped over the head. It is unnecessary to do more, except when the cord is nse and the tension is increased by gentle traction on the nd when it appears to be a hindrance to the delivery of *nk*, in which case the latter *is to be extracted*. For this e, after the retrograde movement of the occiput to one side curred, the head is grasped in the hollows of the two allowing the face to remain free. The head is now l somewhat back, the pelvis of the lying-in woman being same time slightly raised, till the anterior shoulder ds behind the symphysis, when the thorax is lifted out of lva by placing the index finger in the axilla of the posterior er, in true imitation of the natural mechanism and of the curvature of the trunk forwards.

if the extraction of the shoulders is not necessary—and it is so,—the hand which during the exit of the head was on rinæum, remains quietly *in situ*, and closely watches the r edge of the latter; meanwhile the free hand must *iately* be laid on the fundus uteri in order to follow it as dly diminishes in size with the birth of the trunk, and to xpression in case the exit of the latter is delayed. The y of the shoulders deserves special attention in regard to ety of the perinæum, since they might enlarge a small tear, ne involving merely the frænulum, and convert a vaginal perinæal laceration, and since it is not always possible iately after the delivery of the head to exclude the existence a slight laceration. The fingers must therefore prevent the or shoulder from passing out rapidly, and at the same time ly to receive it as it does so. If the perinæum is in great , it may sometimes be saved by allowing the binacromial er to pass out in the oblique, or in some cases even in nsverse diameter instead of the sagittal, by rotating the or shoulder. If the birth of the trunk is delayed through action of the expelling forces, these may be stimulated by the hand flat upon the body of the uterus and rubbing it, urging the woman to bear down vigorously; by exerting y force on the uterus in the direction of the inlet, we can ake up for sluggishness of the abdominal muscles. But y is very great, and there is danger of the child being iated, the latter must be extracted.

6. As the trunk comes into view, it is seized from below hand which has hitherto been lying on the perinæum,

and which is now spread out so as to lift the trunk out of the parturient canal. The delivered child is laid on its side, with its anterior surface directed to the maternal generative organs; it is placed close to the latter, transversely or obliquely between the thighs of the mother, and any loops of the cord that are still coiled round it, are to be unwound. If there is much fluid in its mouth and pharynx, as shown by a rattling, the little finger may be used for its careful removal. If the lying-in woman has been delivered in the lateral position, she must now assume the dorsal.

Meanwhile the other hand, which has closely followed the uterus during the process of its complete evacuation, lies quietly upon it, and holds it firmly in the median line of the body without however pressing too heavily. If both hands were needed for delivering the child, the midwife or nurse should take charge of the uterus in the way described, and act under the directions of the accoucheur. If the new-born child is breathing well, the after-birth period may be first attended to, and after its termination the child separated from the mother; but if a reliable nurse is at hand, she may undertake the supervision of the uterus.

The umbilical cord should never be divided until the umbilical vein has completely collapsed, by which time respiration also will be in full swing; not earlier, unless we have to do with a deeply asphyxiated child. It is however unnecessary and a waste of time to wait till the umbilical pulse ceases[1].

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[1] The observations of Budin, Schücking and others (*l. c.*), which have been fully confirmed by those recently undertaken in my Maternity by Drs. Kroner and Br[illegible] show that when the cord is not ligatured immediately, an increase in the body-weight of the new-born child invariably occurs, which increase is entirely due to the passage into it of the blood from the umbilical vein and its ramifications within the placenta. If the umbilical cord is immediately ligatured, this "reserve blood" is wholly lost to the child; by premature ligation a portion is lost, by postponed ligation (*i.e.* after collapse of the umbilical vein), the whole is retained for the fœtus.

The increase may amount to over 100 grm. (3½ oz.), and is usually though not always in direct proportion to the original weight of the new-born child; in our observations the increase averaged 60—70 grm. (ca. 2 oz.). Its causes lie in the aspiration of the blood by the new-born child, in the weight of the blood itself, and in the pressure which the uterus exerts on a placenta that is still *in utero* (according to Schücking the pressure in the veins rises during the pain from 40—60 mm. to 100 mm.=from ca. 2 to 4 in.). The quantity is increased by the force of the expression which is exerted on the uterus with the object of expelling the placenta; it may be still further increased, by elevating the delivered placenta, and by squeezing the vein in the direction of the child. (We do not yet know what share in the increase is due to fœtal aspiration; this has yet to be decided by observations in asphyxiated new-born children, whose cords have been cut at different intervals of time before the first inspiration. Two order to divide the cord, it is first tied at a point 6—8 2—3 in.) from the navel (where there is a tendency to um- l hernia at a yet greater distance), with a broad ligature and gical knot. If the cord is thin, the ligature should not be ight and firm; if the jelly of Wharton is abundant, not too ; the ligaturing thread should be pulled towards the . The cord is then divided with scissors 2 cm. (¾ in.) from ligature, care being taken not to injure the baby's limbs. placental end need not be tied, since the cord is not cut till mbilical vein has collapsed. As soon as the cord is severed, hild is wrapped in a cloth, handed to the nurse and put into h.

197. It is evident from what has been said in the preceding graph, that the best plan is not to separate the child from mother, until after the expulsion of the placenta, or at least ill the latter is beyond reach of the uterine pressure, *i.e.* has ed the cervix and vagina. In order to bring this about, terus is to be brought (the necessary manipulations being ed out beneath the sheet and above the night-dress, both to l wounding the woman's feelings and to guard against chills) ly into the middle line and perpendicularly to the axis of the , so that the organ is not bent in any way; if the bladder is it must be emptied by means of external pressure, or in case fficulty with a catheter. The hand now grasps the uterus in

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bservations have been made in my Maternity; the cord was ligatured im- tely, 70 (2·5 oz.) and 43 grm. (1·5 oz.) of venous blood being obtained from the

largest part of the reserve blood passes during the first 3—5 minutes after ry, and it does so owing to spontaneously acting causes; doubtless this is the n which is important to the child. Observations on the weight of the child the first few days of its life appear to prove that this increase is necessary for riving of the new-born infant, although on this point we have not as yet ntly numerous observations, and those which are published (*cf.* Hofmeyer and *l. c.*) are in part contradictory. On the other hand, the additional quantity of transferred by artificial means (*e.g.* raising the delivered placenta, and com- ng the umbilical cord) is superfluous, perhaps also injurious; apart from the ility of conveying thrombi into the fœtal blood-channels, severe icterus is said lue to it.

unnecessary therefore to wait for the cessation of the umbilical pulse, provided nbilical cord is divided at the time indicated by the observations referred to ; the pulse in the umbilical arteries may continue for a much longer period t is necessary to wait according to those observations (*cf. inter alios* Ahlfeld, in *f. Gyn.*, xii., p. 489, to whose observations I can add similar ones), when no tant local mechanical stimulus affects the arteries, and it may cease much earlier the latter are by such a stimulus thrown into a state of spasmodic contraction.

such a way that its ulnar side sinks deeply down behind it, the entire hollow of the hand lying on the fundus and the thumb on the anterior wall. If a pain now sets in, the anterior uterine wall is to be pressed against the posterior, and the whole organ pushed somewhat down towards the pelvic inlet, the force only being applied as long as the pain lasts. Should the pains be too few and feeble, the fundus must be rubbed and kneaded with the flat hand, till a contraction comes on, when the pressure is applied in the way mentioned. When this has been done several times, the body of the uterus is observed to become flatter, showing that the placenta has passed out of it. If now the whole organ is strongly pressed down in the direction of the axis of the brim, the placenta may generally be driven first down into and then out of the vagina (*expression of the placenta*), during which process the woman may materially assist by bearing down and by raising her sacrum. This expression of the placenta out of the vagina is however unnecessary; indeed it often causes great pain, and cannot therefore always be accomplished. The best procedure is, when once the placenta has left the uterus, to draw it out by the umbilical cord, the traction being at the same time aided by pressure on the uterus; the line of traction must at first run backwards and downwards, upwards only as the placenta passes out. If the exit does not take place easily, two fingers should be guided along the cord to or near to its insertion, and the placenta pressed into the concavity of the sacrum, while the fingers of the other hand pull the cord in the direction mentioned. It is not advisable to seize and drag upon the actual lobe of the placenta which is lying in the vagina, owing to its liability to tear. The extrusion of the placenta from the vulva must always take place slowly, so that the fœtal membranes which lie behind it and are often still at various points attached to the uterus, may not tear off. This will be avoided if the emerging placenta is twisted several times round its axis; the membranes are thus twisted into a cord by which any portions that remain are drawn out. The placenta, when delivered, must be carefully examined, so as to make sure that everything belonging to it has actually come away.

§ 198. The management of the after-birth period recommended above, is not quite identical with what is known as Credé's method. In the latter, the hand is not placed on the uterus till after the complete expulsion of the child, and then

s on pains by friction &c., *i.e.* by stimulation, the placenta
afterwards expressed from the uterine cavity in the way
ibed; Credé's method therefore amounts practically to the
ssion of the after-birth. I, on the contrary, lay most
s (following in this respect the plan of the Dublin Rotunda)
arly and regular, *i.e.* generally distributed, contraction of
terus, since this is the cause of detachment of the placenta,
uch detachment, not the expression, is the important matter.
not only do I closely watch the uterus all the time that its
ation is comparatively rapidly taking place (*i.e.* from the
ent that the head passes out), but I follow and mechanically
ulate it, and thus insure that the contraction which takes
when the cavity is suddenly emptied, shall not only be
ous but also general; in this way I insure early detach-
, and by a constant supervision prevent any irregularities
e contraction. According to Credé's method, anomalous
action may come on unnoticed between the birth of the
and the beginning of the "expression," which is not
ible with the method which I have described. I repeat
fore: *a constant supervision of the uterus from the moment*
ead is delivered, by which general contraction of the uterus
detachment of the placenta are insured, is the main point; the
ession of the placenta from the vagina may then follow, but
t essential, and, as it is often very painful, may be impracti-
, which cannot be said of my method. Mine also is the only
prophylactic against anomalies of the after-birth period, as
at least as they are preventible. At any rate if my recom-
dation is followed in every case, an anomaly will be recognised
on as it arises, and this is no slight advantage!

199. After removal of the placenta, the vagina must be
ated with cool 2 per cent. carbolic water, and the hand
h is supervising the uterus must continue to do so for some
yet, until the accoucheur is confident of its permanent
ction. It is then a good plan to bind the abdomen mode-
y firmly with a wide bandage, preferably with a hand towel,
h is passed tightly round the hips. In this way the intra-
minal pressure which has been so suddenly lessened by the
ery is to some extent restored, the lax abdominal walls,
indirectly the uterus also obtain support, and the woman
riences great relief. Before the accoucheur takes his

departure, he should examine the external genitals, and cleanse them from blood &c. with a soft linen napkin dipped in 2 per cent. carbolic water (a sponge should not be used, unless it is quite new and has been thoroughly boiled). Any perinæal tear that may be present should be immediately sewn up, but slight injuries and abrasions may be left to themselves. Another bed near at hand is now to be prepared, and as soon as it has been thoroughly warmed and provided with a fresh clean waterproof layer, the woman should be carried into it; or if the same bed in which she was confined is retained, this should be cleansed by the removal of all soiled articles, and fresh, thoroughly warmed, clean sheets should be pushed under her. During the necessary changes of position, the woman herself should co-operate as little as possible, and lie quite passive. It is unnecessary to change her body linen, if the night-dress and jacket were turned up during the period of expulsion, as was recommended above; but if a change is requisite, only warm and thoroughly well aired linen must be given.

The Use of Chloroform in Labour.

§ 200. I need scarcely lay down the axiom that chloroform narcosis is as justifiable in all obstetrical as it is in surgical operations, and that it is indispensable in the severer operations. Indeed it is of more value here than in most surgical operations, since it not only serves to allay pain and give rest, but directly facilitates obstetrical operations, by checking all bearing down and diminishing the tension of the abdominal and pelvic muscles, even of the uterine muscle; it is therefore specially advantageous for the lying-in woman. Chloroform may also be used with benefit for certain forms of general and local cramp or neuralgia during labour, just as it can in the non-puerperal condition; more will be said of this use, when the several affections are described. When however we speak of administering chloroform during labour, we do not refer to such cases, but rather to its value in simply relieving pain during labours which belong to the category of normal ones.

If a woman in labour, who is otherwise healthy, inhales chloroform, she very soon falls into a quiet sleep, in which perception is somewhat diminished, and general sensibility lulled, while consciousness remains unaffected. Above all she seems scarcely to notice the uterine contractions, or the pain accompanying them. The contractions themselves are scarcely, if at all, altered. Their frequency occasionally diminishes a little, but this soon regulates itself, and the somewhat prolonged intervals between the pains seem to depend entirely on the generally quieter condition of the woman. Each individual contraction is more energetic than before, and often more effectual, since the woman no longer throws herself wildly about or contracts her abdominal muscles; although the assistance which the abdominal contractions give, is not entirely absent at the height of the pains. During the intervals the parturient woman lies quietly asleep; when a pain begins, she grows restless, groans, bears down and sometimes also tosses herself about. When the pain ceases, the previous quiescent state returns, the woman answers questions as if half asleep; she seems to be aware of the pains, but certainly does not suffer from them. This *anæsthetic effect* of chloroform is scarcely ever so well marked as it is during parturition; the effect being the more striking, the more agonised and exhausted the lying-in woman was before; for inducing this anæsthesia only very small quantities of chloroform are necessary. If however the chloroform is administered continuously, a deep *narcosis* soon comes on in these as in other cases. The pains grow more sluggish, the intervals between them longer; the former however do not disappear altogether, for when once the parturient activity of the uterus is set going, it continues without interruption, although the rhythm may be retarded, till evacuation results, or till the nervous irritability is entirely exhausted. On the other hand in a state of deep narcosis the activity of the abdominal muscles diminishes and finally disappears. Vomiting also is very apt to supervene. In simple anæsthesia I have scarcely ever noticed it, a fact which may be due in part to the stomach of a woman who has already been in labour for a considerable period, being usually empty.

Although the induction of prolonged narcosis therefore may exert an injurious influence on the action of the pains as well as on the general organism, this is certainly not true of mere anæsthesia, even if it should be prolonged for hours. Experience proves this, and it is highly probable that the increased cardiac and respiratory activity which accompanies each pain, and is seen even when the woman is under chloroform, is mainly the cause of the safety with which chloroform is given in obstetrical practice. Experience moreover has shown that the atony of the uterus which it was feared would supervene after labour, does not occur, so long as the uterus is kept under supervision, as described above, from the moment the child is expelled.

As far as the *fœtus* is concerned, no unimpeachable clinical observation has yet been published in which a fœtus was injured by chloroform administered to its mother[1]. Chloroform is indeed found in the expelled placenta, where it might of course be derived from the maternal blood that is still adherent; moreover experiment has shown that the reducing substance which is found in the urine of persons who have inhaled chloroform, is also present in the urine of children whose mothers inhaled it, and further that such reducing substance is formed in the fœtal organism (Zweifel); and that the chloroform therefore passes as such into the fœtal circulation. But to what extent this is injurious to the child is still uncertain; probably it is not so at all.

§ 201. It follows from all this that it is always justifiable to induce chloroform anæsthesia, even in labours which otherwise run a normal course, as soon as the pains become very severe, and cause great excitement and exhaustion by their long duration. Of course any individual susceptibilities as well as ordinary counter-indications (diseases of the lungs, heart and great vessels, goitre) must be borne in mind. Where the above-mentioned conditions (severity of pains &c.) do not exist, chloroform should not be given; *e.g.* never simply to get rid of the suffering of labour. The inhalation moreover should be interrupted at intervals, when it is necessary to continue it for a long time; otherwise a very prejudicial accumulation might take place.

The time for commencing the administration must depend on the condition of the patient, and may arrive as early as the period of dilatation. It is well to desist during the exit of the child, since the assistance of the fully conscious woman is often necessary for the preservation of the perinæum. Chloroform should be inhaled during the pains; it is in this way that the d object will be most easily and quickly attained, since ation is accelerated during the pains, and any struggling st the odour of chloroform is most rapidly overcome; when ain ceases, the chloroform should be removed. The lying-man should not be compelled to assume any special posi- her bladder must be carefully supervised during the thesia. Quiet must be enjoined to those present, and much g is to be forbidden; fresh air should be frequently admitted the room. When the inhalation is finished, the woman d not be waked, but be allowed to recover spontaneously; the birth of the child, the uterus must be supervised with al care. No particular form of inhaler is necessary; a or a handkerchief folded in the form of a cone, answers purpose.

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[1] According to Runge (*Arch. f. Experiment. Pathologie*), chloroform so lowers the blood-pressure of the mother, that the fœtus may perish in consequence without the mother dying. But clinical experience of prolonged chloroform narcosis in lying-in women does not confirm this observation.

is very doubtful whether *chloral* is able quite to take the of chloroform as an anæsthetic, for it is mainly a hypnotic. like *subcutaneous injections of morphia*, it is everywhere in here rest, sleep and the arrest of irregular pains and bear-lown are desired. In regard to morphia, I will only add parturient women as a general rule require large doses, and them well.

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Multiple Pregnancies and Births.

§ 202. A multiple pregnancy is one in which several fœtuses are developed simultaneously. These are usually two in number (twins), in rare cases three, four, or even five. There are undoubted examples of five; one case is accurately related in the *Journal des Connaiss. méd. chirurg.*, No. 12, 1867, by Galopin in Illiers; others have been communicated by Szauer (*Wien. Med. Presse*, 1877, No. 50), by Pearce and Volkmann (*Centralblatt f. Gyn.*, 1877, p. 24; and 1879, p. 461), and I myself have seen a preparation of five fœtuses in Ireland. More than five have not been observed. Practically we are only interested in twin births.

Multiple pregnancy is an anomaly both in itself, and indirectly by much oftener leading to difficulties than does single pregnancy. Nevertheless it is dealt with in this Part, just as presentations of the face, brow, and pelvic extremity have been, since as a rule twin births pass off spontaneously and successfully, and like the above presentations, are not far removed from normal ones.

The *frequency* of multiple pregnancies varies in different countries and years, and runs parallel with fertility. Bavaria, Ireland, and Russia show the highest ratio, France the smallest; Germany taken as a whole approaches the average. This in the case of twins amounts approximately to 1 : 80, in the case of triplets to 1 : 6—7,000 of all births ; lying-in institutions for obvious reasons show a greater proportion. The frequency increases with the number of the pregnancy, and the age of the mother. Heredity appears to exert an influence (Goehlert), and one twin pregnancy undoubtedly predisposes the woman to its recurrence[1].

Twins may be of the same or of different *sex* ; the latter is most common ; male twins come next in frequency, two females are rarest. The male sex predominates here also, though less so than in births generally (*cf.* Veit *inter alios*). The excess in the number of boys over girls increases with the advancing age of the parents, and especially with the relative age of the father, and since from what is said above, advanced age as a whole disposes to multiple pregnancy, the excess of boys in the latter is explained.

§ 203. Twin fœtuses are either developed from *two ova*, origi-
ating in the same follicle or in different ones (if the latter,
here must also be two corpora lutea, either in the same ovary or
ne in each), or from a *single ovum* containing a double germ.
he relations of the fœtal membranes show whether development
ok place from two or from one ovum, although it may under
me circumstances be very difficult or even impossible to decide
e matter. The *decidua* is of course always single (except
ere the uterine cavity is double), but the fœtal membranes
l the placenta may be single or double. If there are *two*
rions, the fœtuses have developed from different ova ; there
then two amnions and two placentæ, the latter being either
e distinct, or blended with each other at their contiguous
s into an apparently common placenta. When the placentæ
uite distinct, there is always a layer of decidua between the
ons of the two ova, the latter having become imbedded in
ns of the uterine mucous membrane which were far apart.
when the placentæ form one mass, the decidua as a rule
ls for the whole distance between the two chorions, proof
the case of these ova also the reflexa grew up round each
and that the placentæ only came into contact later on ; if
r the dividing layer of decidua does not exist between the
s, the two ova became imbedded in the uterus so close to
er, that a common reflexa grew round them both. But

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[1] Puech, *Annales Gynécol.*, April, 1877.

in all cases where two chorions are present in the after-birth, the placental vessels of the two fœtuses are entirely distinct, or only present unimportant anastomoses.

If only one *chorion* is present, the fœtuses have developed from a single ovum with two germs, for we have no evidence that two chorions which were originally distinct can afterwards blend so to form a common chorionic cavity; where there is a single chorionic cavity, we never find traces of the chorion having been primarily double. The placentæ, though originally of double formation, always become fused in the case of a single ovum into one mass, and every vestige of a septum disappears. It is not rare in such cases for considerable anastomoses to exist between the ramifications of the umbilical vessels of the two fœtuses; and not only between the veins and arteries of the two sides, but sometimes also between a vein and an artery, the connection being effected both in the deeper portions of the placenta, and by thick vessels lying on the surface. The more one umbilical cord owing to a marginal or velamentous insertion is at a disadvantage compared to the second, the more does its collateral anastomosis with the latter develop, so that each controls an equal part of the placenta. The cords may be inserted near to each other into the margin, or at diametrically opposite points, nor is the velamentous insertion rare. The *umbilical vesicle* is as a rule double, even when there is a single chorionic cavity, the two vesicles often lying close together, usually between the portions of the two amnions which are in contact[1]. Twins lying in the same cavity are always of the same sex, and much more alike than those developed from different ova. The latter show such resemblances as children do which have been born from the same parents at different times, but those occupying a common cavity are strikingly similar, their difference in weight is less, and they attain to a greater similarity in bodily structure than do the former.

A single chorionic cavity occurs once in 8 twin pregnancies:

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[1] According to Ahlfeld (*Arch. f. Gyn.*, xi.), when the umbilical vesicles are independent of each other, the twins have developed from two different blastodermic vesicles; when the umbilical vesicles lie close to each other in the neighbourhood of the amniotic partition wall, the fœtuses have developed from two different blastodermic vesicles or from *one* whose vitellus divided; if there is only *one* vesicle placed between the insertions of the umbilical cords or in one of them, the twins have developed from a *single* vitellus.

the *amnion* on the other hand is double almost without exception, one amnion being only found about once in 132 twin pregnancies (Ahlfeld). It may then have been originally single, since a common amniotic fold may grow up round two embryos originating in the same blastoderm. The common amniotic cavity however may also have been derived from an originally double cavity by a disappearance of the party-wall. For the amnion can be re-absorbed in consequence of inflammation, and traces of such are sometimes found between the insertions of the cords where there is but a single amniotic cavity, in the form of lines of fat and adhesions of the amnion (between these points of insertion) with the tissues lying beneath it, which have undergone fatty degeneration. Where the amnion is single, the insertions of the cords are frequently close together, and portions of each amnion must therefore have been pushed into the angle which the vessels inserted into the chorion close together, form with one another; and this may in consequence of fœtal movements easily lead to inflammation and atrophy from pressure. In some observations moreover distinct remnants of a former partition wall have been found.

When there is a single amnion and the *cords* are inserted close together, the latter *may interlace with one another*, or there may be a *fork-shaped cord*, *i.e.* a cord which, while containing duplicate vessels, is single for some distance from the placenta, and then divides.

In pregnancies with triplets or four fœtuses, the fœtal appendages (corresponding with the mode of development of the ova) are arranged much as in the case of twins, although the relations are naturally more complex. In the case of triplets, there is as a rule one independent ovum, and another containing two germs; here however as also in the case of four fœtuses, there may be one chorion common to all the fœtuses. The relative frequency of a common amniotic cavity appears to rise with the number of the fœtuses.

§ 204. As a general rule *twin fœtuses* are *smaller*, and *weigh less* than other new-born children. This is due in many cases to the twin pregnancy terminating more often than the single ones before the full term of 39—40 weeks, since the uterus owing to its unusual distention is earlier stimulated to contract. But even when the duration of pregnancy is normal, twins are more frequently below the average measurement than are single children, though the weight of both taken together exceeds that of the single one. The reason is no doubt that the maternal organism cannot so easily provide material for nourishing two fœtuses as it can for one; their growth too may be mechanically hindered. *Twins* are almost invariably *unequally developed*, and great differences in this respect are met with, even when the shape is natural. The cause is probably local, one fœtus preventing the other from developing; possibly owing to one ovum being attached to a part of the uterus which offers more favourable conditions for its growth, and shields it from the pressure of the second, while the latter matures under less advantageous circumstances. Thus in animals which bring forth several young at the same time, it is observed that those fœtuses which lie towards the point of the uterine horns are frequently smaller than those situated deeper down. This difference in development is especially and not infrequently noticeable in uterus duplex, where each half contained a fœtus. Corresponding to the disparity in the size of the fœtuses, the placentæ or the placental halves belonging to them, are also unequal in size, while the length and thickness of the umbilical cords are often in direct proportion to the development of the children. It is not true that the fœtus born first is always the best developed, as has been assumed in disputed cases as to which was born first. Even in my own short series of observations, it has happened that the smaller fœtus was expelled first.

It is interesting to note the *different fate which sometimes overtakes twins*, while still in the uterus. Thus one fœtus may perish or be discharged by abortion, while the other continues its natural development[1], and in rare cases the ovum which had perished prematurely is found to have degenerated into a mole. It is commoner however for the dead fœtus to remain for months in the uterus side by side with the one which is advancing towards maturity, and to shrivel up without undergoing further change; in such a case when the mature child is born, the compressed second ovum with its similarly flattened embryo is found

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[1] *Cf. inter alios* the case recorded by Linton (*Centralbl. f. Gyn.*, 1878, p. 518), in which abortion of one fœtus took place at the 4th month owing to placenta prævia, the other being expelled in a mature condition 5 months and 6 days later.

outside the fœtal membranes of the first (*fœtus papy-*
s, f. compressus[1]).

asionally it happens that after the birth of the most
ped child, the second less developed fœtus is not imme-
y expelled; the latter remains behind *in utero*, and is
orn after an interval, which may amount to several weeks,
uring which it has undergone further development. The
striking instances of this kind have been noticed with
s duplex.

05. Upon these facts and upon the frequent disparity in
velopment of twins, the hypothesis has been founded that
o fœtuses originated at different times, that the ova were
gnated at different dates, that *superfecundation* occurred.
ding to this hypothesis, an already pregnant woman may
gh a later coitus become pregnant a second time. As far
is question relates to *early* superfecundation, *i.e.* to the
ate impregnation of two ova discharged during the same

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formation of fœtus papyraceus is explained by the fact that the surviving
maintains a vascular connection with the dead one, which thus carries on a
ive existence, which prevents the usual maceration from setting in. This
occurs when the twins are derived from a single ovum, and a number of
ons are therefore present in the conjoint placenta, which are common to both,
the circulation is in part at any rate a common one. If such cotyledons derive
teries from one fœtus and their veins from the other, the two hearts work in
ne direction in the more or less common vascular circle. If then (as is so
tly the case) the two twins are not equally well developed, the stronger heart
ver a portion of the work of the weaker, and the latter may become so much
ed, that the fœtus to which it belongs perishes. Again, the more vigorous heart
es a larger quantity of liquor amnii than the other, and the weaker fœtus (the
mnii of which diminishes more and more) comes to be straitened for room,
ter its death will be compressed and flattened. The heart of the surviving
ontinues however for some time to maintain a slight amount of metabolism in
er fœtus.

s papyraceus has also been met with when the chorion was double, and must
due to an interruption of the circulation owing to anomalies in the umbilical
It is evident that the same cause may be effectual where the chorion is single,
en it is double there are sure to be vascular anastomoses between the
e.

y take this opportunity of mentioning that when considerable *arterial trunks*
two embryos anastomose with each other in the earlier stages of development
cording to Ahlfeld, to the union of two allantoides that developed at different
and when the heart of one fœtus contracts more forcibly than that of the other,
nds its stronger arterial current in direct opposition to the feebler arterial
of the weaker heart, the onward flow of blood on one side of the anastomoses
checked, and the blood will flow back towards the less powerful heart; the
hen becomes paralysed and atrophied. The fœtus with the weaker heart
rates into an "acardia."

ovulation period, we have no reason for doubting the possibility of such an event, since there is nothing to prevent newly introduced spermatozoa from penetrating to the ovum, and since superfecundation certainly occurs in animals, in whom polyandria is very common. But in the case of man, its occurrence cannot be proved where there is but one father, or where the fathers belong to the same race. Even those cases in which women have given birth to children of two races after having admittedly had intercourse with men of different races prove nothing, since in cross breeds the children do not always equally share the paternal and maternal peculiarities; and, just as a child may sometimes resemble the father most, sometimes the mother, so also in the case of twins resulting from such a cross, one may only resemble the father, the other only the mother. Superfecundation moreover does not explain the frequently great disparity in the development of the fœtuses, nor why the dates of birth are often so widely separated, since the second conception must take place within a short interval after the first.

This is what *late* superfecundation (*superfœtation*) is supposed to do, *i.e.* the impregnation in a person already pregnant (by a coitus occurring months after the first pregnancy began) of an ovum, which has been recently discharged and therefore belongs to a subsequent ovulation. *This superfœtation however is a physiological impossibility*, since physiological ovulation ceases as soon as pregnancy has commenced, and since its continuance during the latter has never yet been observed. Less weight can be placed on the obliteration of the uterine cavity by the decidua reflexa blending with the vera as disproving the possibility of superfœtation, since this blending is only completed towards the end of the third month, and is liable to exceptions in diseased conditions of the uterine mucous membrane; nor does the argument hold good where the uterine cavity is double. Further, the assumption that fœtuses which have reached a different degree of development originated at different times, is not (even if it were otherwise possible) admissible, where the differences in development are noticed in fœtuses developed in a *single ovum*, which is not rarely the case; for probably no one would assert that an ovum with a two or even more months fœtus in it could be again impregnated. And since the unequal development of the fœtuses originating in one ovum, can be uite simply explained by an unequal distribution of the nutrient aterial and by want of room, this explanation will also suffice n other cases to explain the difference in the development of wins; all the more as the same phenomenon is quite as fre-uently met with in the so much rarer cases of triplets.

The instances in which twins of similar or nearly similar evelopment have been born at a considerable interval, cannot e explained by the hypothesis of superfœtation. The noticeable oint in such is that the uterus in which labour has begun, ay after partially expelling its contents, again become quiescent nd only later resume its work; it is also remarkable that the urther development of the remaining ovum is not interfered ith by the diminished size of the uterus, while the arrest of æmorrhage from the area of attachment of the placenta elonging to the first ovum, is somewhat more easily under-tood without a complete retraction of the uterus. Never-heless these events, though so greatly at variance with what sually occurs, are not altogether inexplicable when compared ith other pathological phenomena in the uterus, but the sup-osition of a superfœtation throws no light on the question. And f twins, in cases where the pregnancy has lasted an equal ength of time, may yet be unequally developed, and are not orn at the same time, the one remaining behind and making up or what it has lost, this only shows that in multiple pregnancy lso the degree of development of the fœtus influences the date f labour. Superfœtation then is physiologically untenable, xplains nothing at all, and may be set aside as an exploded ypothesis.

§ 206. Twin pregnancy can rarely be *diagnosed* with perfect onfidence. Various indications however of it are mentioned: hus early and great enlargement of the uterus; an unusual egree of discomfort consequent upon this enlargement; very idely distributed and strong fœtal movements; *division* of the terus into two elevations along the linea alba or in an *oblique* irection by means of a *furrow*, or at any rate a distinct trace of wo horns at the fundus; great expansion of the *lower* segment f the uterus with no or a very unstable presenting fœtal part. ll these indications however are *relative*, and therefore unreliable henomena, and may be caused by an *excessive* amount of liquor mnii or of the [illegible] urious liquor amnii (*cf.* § 91), or by voluminous child. They lead, it is true, to a suspicion of twins, but it is an old experience that when twins have been prophesied on such grounds, labour generally undeceives and *vice versa*.

The diagnosis becomes more probable, when we are able to exclude the presence of an excessive quantity of liquor amnii, and can distinctly feel numerous fœtal parts, especially if these are both unusually numerous and small; it becomes certain when, as sometimes happens, two heads are definitely recognised at opposite points of the uterus. Auscultation also may make us certain; not merely if we distinctly hear the fœtal heart sounds at opposite portions of the uterus, but only if their intensity diminishes from these portions in a peripheral direction, and if they are very feebly or not at all audible in the intervening median portion. A different rate of beat heard at different spots is only of importance, when made out at the same time, *i.e.* by two observers, or when in the case of a single examiner a very short interval elapses between his examination of the different spots; for it is well known how variable the rate of the fœtal pulse is, and how rapidly it is altered by such active or passive movements of the fœtus as are provoked by the examination. It is moreover possible for one person simultaneously to auscultate different spots, if he will take the trouble; and should he find that the pulsations are not synchronous, the diagnosis becomes certain (Küneke).

During labour the diagnosis may be facilitated by the presenting part being more easily recognisable than it was before; here however we must guard against deceptions, just as during pregnancy. The diagnosis is sometimes rendered certain by the fœtal heart sounds being heard, while the presenting child is found to be dead (this I have seen in one case), or while a pulseless umbilical cord is presenting (seen three times); so also when through the bag of membranes, or even after its rupture, many similar fœtal parts can be felt, or such as could not possibly lie together where there is only one fœtus (a foot near the shoulder, two right hands or feet); when two bags of membranes are discovered, or at any rate the indication of the partition wall dividing them (Depaul); and finally when the presenting fœtal portion is so small that it cannot possibly belong to the same fœtus as do the other parts that can be felt in the still elevated uterine fundus.

After the birth of the first child, it is easy to make out that a second still remains in the uterus. The matter is at once settled, if when the head or trunk, as the case may be, is born, the hand is laid on the fundus uteri, and grasps the organ according to the rules laid down under the "Management of Labour." The size and consistence of the uterus, its tense condition during the pains show at once that it contains another fœtus. The recognition of fœtal parts, and in some cases the fœtal pulse and the vaginal exploration then furnish more exact conclusions.

A pregnancy with three or four fœtuses can only in very rare cases and under exceptional conditions, be diagnosed before the actual expulsion of the fœtuses.

§ 207. As already mentioned, twin pregnancy often terminates prematurely as a result of the early great distention of the uterus and of the not uncommon premature death of one fœtus; out of 98 cases I find 27 *premature births*=27·5 per cent., Reuss estimated the ratio at 26·5 per cent. in the Maternity at Würzburg. *Labour* however usually passes off spontaneously and successfully. It may be compared to two single labours following rapidly upon each other, the second lasting a much shorter time than the first, since the period of dilatation is common to both. In the second moreover the pains are often sluggish and more or less ineffectual, at least as long as the bag of membranes continues intact, indeed this variety of uterine inertia may be of diagnostic importance; but as soon as the liquor amnii has been discharged, and the size of the uterus is diminished, this changes. Progress then usually becomes very rapid, owing to the small size of the fœtuses, and twin labours do not on an average last longer than a single one. The birth of the second child generally follows that of the first within a quarter of an hour, most rapidly when both were enclosed by one bag of membranes, or when the membranes of the second burst before the birth of the first; in over 80 per cent. the interval does not exceed one hour. Longer intervals are as a rule cut short by interference on the part of the accoucheur, and such a shortening is often rendered necessary, not by the length of the interval, but by other anomalies (abnormal presentations of the second fœtus, hæmorrhage).

The *expulsion of the placentæ*, whether separate or blended, does not generally take place till after the birth of the second child; when separate, they rarely pass out at the same time, that of the first fœtus usually emerges first, the opposite being exceptional. Occasionally the first child is immediately followed by its placenta, which therefore precedes the second child, and it may happen that the second placenta precedes the second child. When the two placentæ form one connected mass, a portion of it may separate after the birth of the first child and be expelled, the remainder only following the second child[1]. The after-birth period owing to the size of the placenta, and to the lax condition of the uterine walls, lasts as a rule longer than with a single labour; still when the uterus is properly attended to, it may generally be terminated quite as soon.

§ 208. The *position of the two fœtuses* relative to each other, varies greatly. During labour two head presentations are commonest, or one head and one pelvic presentation; two pelvic presentations come next in frequency, then one head and one transverse, one breech and one transverse, lastly two transverse presentations. Out of 1,144 pairs (899 collected by Kleinwächter, 203 by Reuss from the Maternity at Würzburg, 42 of my own) the fœtuses showed:

two head presentations	562	times	= 49·1	per cent.
one head and one breech presentation	362	,,	= 31·7	,,
two breech presentations	99	,,	= 8·6	,,
one head and one transverse presentation	71	,,	= 6·18	,,
one breech and one transverse presentation	46	,,	= 4·04	,,
two transverse presentations	4	,,	= ·35	,,
	1,144	times	= 99·97	per cent.

Out of 2,288 fœtuses, there were therefore of:

head presentations	1,557	= 68	per cent.
breech ,,	606	= 26·48	,,
transverse ,,	125	= 5·46	,,
	2,288	= 99·94	per cent.

The excessive frequency of breech and transverse presentations, when compared to those of ordinary labours, is evident from these tables. Most of the transverse presentations are secondary, and occur mainly with the second fœtus; as a rule they result from the sudden discharge of the liquor amnii, and from the very roomy condition of the uterine cavity after the first birth. Change of lie and position are by no means rare with the second child, so that the presentation and position at labour do not necessarily show what they were before it.

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[1] When there is a common placenta and a true marginal or velamentous insertion of the cord of the first fœtus, this cord may be torn from the placenta as the fœtus is expelled. The placenta therefore which is discharged after the completion of the labour may seem to possess only one cord, and the practitioner is apt to be misled through inattention, and unnecessarily to introduce his hand into the uterus in search of a second placenta.

§ 209. The numerous anomalies of presentation, position and attitude which are noticed in twin labours, owing to the small size of the fœtuses and to the large size of the uterine cavity, possess no unusual features, and for details I must refer to the appropriate sections. Special interest however attaches to the *simultaneous entrance of both fœtuses into the pelvis*, and I must therefore describe it here, although a purely pathological occurrence; indeed twin pregnancy is an anomaly from beginning to end.

Both fœtuses may, while their membranes are still intact, present simultaneously at the pelvic inlet; but as soon as one bag of membranes ruptures, its fœtus descends and pushes the neighbouring bag of membranes to one side. The same thing usually occurs, when the fœtuses occupy a common amniotic cavity and lie side by side above the pelvis; when the liquor amnii is discharged, one moves aside. In either case should it be necessary, *i.e.* should the selection be long delayed, the bag of membranes, or one of them, if there are two, may be opened, and the nearest presenting part (preferably the head) brought down till it blocks up the pelvic inlet, while the other presenting part (either with intact membranes or after their rupture) may at the same time be pushed back; the appropriate lateral posture should be enjoined. The same principles must be followed, where both twins present alternately.

But when the amniotic fluid has been discharged, both fœtuses may simultaneously or soon after one another descend into the pelvis, before the first one has blocked up the way; under such circumstances they mutually interfere with each other's progress. This occurs when both bags rupture simultaneously, or when that of the fœtus which is placed highest gives way first, or (and this is commonest) when both twins lie in a single sac. The condition is met with once in 90,000 labours (Braun), and is therefore very rare.

a. When *both the heads present* and occupy the pelvis, the head of the second child lies in the cervical excavation of the first; or else the first head is born, but the second one pressed against its neck stops its further progress. In the former case the diagnosis can scarcely be made before the birth of the first head. Neither event is possible, except where the twins are small. If there is no urgency, the course of events should be waited for, especially where the pelvis is wide and the expulsive forces are strong. Under other circumstances, the two heads should be extracted one after the other with the forceps; except where one fœtus is dead (a difficult point to determine, if only one is dead and has not yet undergone maceration), when its skull should be perforated.

b. Both children may present with the pelvic extremity, either with the breech or the feet, but this is one of the rarest complications. It is the exception for serious dystocia to ensue from one fœtus preventing the progress of the other, since the lower end of the body has a simpler shape than the upper, and the two breeches cannot interlock owing to their rounded form. It is sufficient to draw down the lowest breech or pair of feet, while the other is pushed up and to one side. If necessary, the whole hand should be introduced so as to grasp the two feet which belong to each other. Again, the second child may ride on the transversely placed first one, an anomaly which can always be recognised, if the rule is followed in any case of "*confusion des membres*," of introducing the whole hand into the lower segment of the uterus, after inducing chloroform narcosis, and of accurately examining the presentation and other relations of the fœtuses or the fœtus, before any rectification is attempted.

c. One child may present with its pelvic extremity, the other with the head. In such a case the former, being the less bulky, especially when the feet present, descends first, and is delivered as far as the umbilicus or even the neck, but from this point the heads are so interlocked as to form a serious obstruction to delivery—*interlocking twins*. Either the heads lie face to face with the two lower jaws hooked under each other (fig. 57), or the face of the one is turned towards the occiput of the other or lies against its nape, or both occipital regions are interlocked. The diagnosis is usually easy, inasmuch as the delay in the delivery of the first child leads to an accurate exploration of the pelvic cavity, if necessary with half the hand, and this reveals the condition of things.

Since the first child is more severely squeezed than the second, and is delayed owing to its pelvic end presenting, it runs much more risk than the other. If the parturient canal is very roomy, the fœtuses small and the pains very powerful, both children may be simultaneously and spontaneously expelled. But as a rule when spontaneous delivery occurs, the head of the second child is expelled side by side with the expelled trunk of the first; then comes the head of the first and lastly the trunk of the second, or else the second child is entirely delivered before the head of the first.

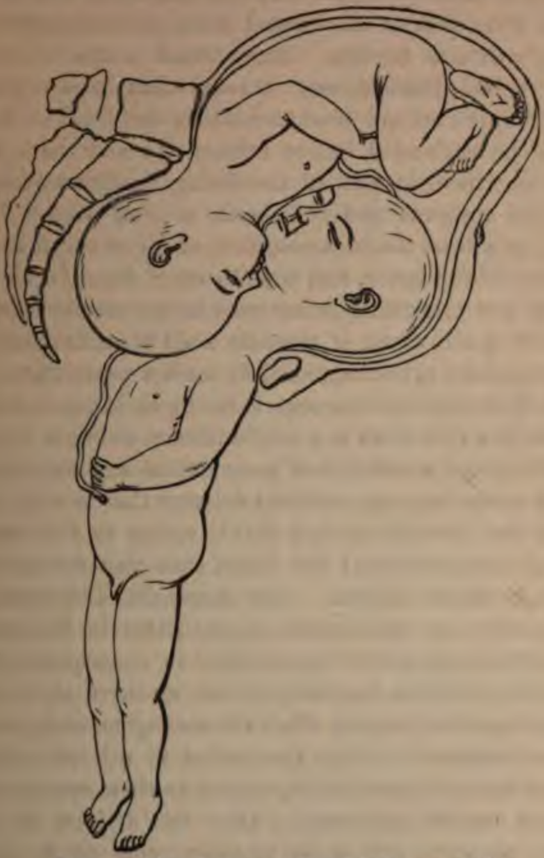

Fig. 57.—After Barnes. ("Obstetric Operations.")

In the majority of cases of interlocking however, labour must be terminated artificially. It may occasionally be possible to push the head of the second fœtus back, and thus to get rid of the difficulty, but as a rule the best plan will be to deliver the head of the second child with the forceps, and (considering how bad the prognosis always is for the first child) immediately afterwards to completely deliver the second child. Yet under some circumstances it may be advisable, indeed even necessary, after the extraction of the second head, immediately to deliver the first with the forceps. The natural course of events is imitated in both proceedings. On the other hand it sometimes happens that the second head cannot be delivered with forceps, and must be perforated before extraction; and there will also be cases in which, in view of the living condition of the child whose head presents and the death of that whose trunk is delivered, it will be the best plan first of all to crush the higher placed head of the latter, and thus to make room for the forceps delivery of the presenting living head of the second child. The amputation of the trunk of the first child is inadmissible, since the disproportion is not remedied by such a proceeding.

§ 210. The *prognosis* in regard to the children, is much less favourable in a twin than in a single labour, owing to their small size, the frequent anomalies of presentation and attitude and to the much more frequent artificial delivery that is required (it is especially bad for the second child, owing to the number of transverse presentations); the death rate also during the first few days is much higher. The increased distention of the uterine cavity, the commoner irregularities in the course of labour, and the operations necessitated in consequence increase the morbidity and the mortality of the mothers also, although not to an important extent, when the management is good.

This *management* during the period of dilatation does not differ from that of single births, so long as there are no anomalies to demand special treatment. After the delivery of the first child, the placental end of its umbilical cord must always be ligatured, since there is a possibility of both children originating from a single ovum, and in such a case the two vascular systems frequently anastomose. Twins are rarely welcomed with pleasure, the mother should therefore not be distressed by the information of their advent being conveyed too abruptly. If the relation of the second child to the uterus is normal, the return of the pains may be patiently awaited, so as to allow the uterus gradually to adapt itself to the changed conditions. The delivery of the second child is to be conducted according to the same rules as any other labour; but here especially we can assist by external pressure. The rules for managing the after-birth period must be adhered to even more minutely, if possible, after the birth of the second child than after an ordinary labour, since the uterus in consequence of its previous distention shows a great inclination to relax, since the placental mass as well as its area of attachment are larger, and the danger of hæmorrhage is thereby increased. The hand which is supervising the uterus must not leave it for a moment.

The placentæ should not be extracted (unless there are special grounds for doing so) till they lie entirely and low down in the vagina. In removing them, traction should be made on both umbilical cords simultaneously; if this is ineffectual, then either on one or other, the after-birth often following more readily when this is done. But if the placenta of the first child is found immediately behind it, it should be left to lie quietly where it is, unless it has quite come down and can be removed without the use of any force. The supervision of the uterus, when labour is completely over, is to be continued for a longer time than after a single birth; some doses of ergot should also be given.

The question how long it is well to wait before interfering, in cases where the interval between the two births is delayed, can only be answered when the second fœtus still lies in its own bag of membranes; if there is no second sac or if it has burst prematurely, delay in the advance of the fœtus must be dealt with in reference to its causes, and to the conditions found in the individual case. But when the membranes are intact and circumstances are otherwise favourable, the limit for waiting may be set at somewhat under an hour; this is the limit of spontaneous termination in more than 80 per cent. of all twin births, and there is all the less reason to wait longer, since the after-birth of the first child is generally still retained and does not permit further delay, since the lying-in woman has had abundance of time to recover by the time mentioned, and since if the pregnancy is terminating at or nearly at the full term, we cannot look for any very long natural interval. In such a case it will be well therefore to attempt to bring on stronger pains, by applying external pressure, by friction and ergot, and if this does not succeed, the liquor amnii may be let out. Should it however happen that one placenta immediately follows its own fœtus, especially if the latter is immature, while the other ovum lies intact in the uterus, and if the latter again becomes quiescent, it is advisable, bearing in mind the recorded cases in which the second has continued to develop after the birth of the first, and has been born after a considerable interval, to desist from accelerating delivery, so long as the condition of the mother does not imperatively demand it.

The description given of the course and management of twin labours in the main holds good for *labour with triplets or quadruplets*. On easily intelligible grounds, anomalies are here still commoner, and insufficient contraction of the uterus and hæmorrhage are especially to be feared. There is but a faint chance of maintaining the fœtuses alive, particularly as they are almost always born a very long time before attaining maturity; four fœtuses have however been kept alive.

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III. *The Puerperal State.*

§ 211. The changes brought about in the maternal system by pregnancy, begin to undergo retrogression at the time of parturition and continue to do so after delivery. The period of time which is necessary for the completion of this "involution" extends over several weeks, and is called the *puerperal period;* the person concerned being spoken of as a *lying-in woman.* Six weeks elapse before involution is complete, indeed sometimes even more, before the uterine mucous membrane is fully reformed.

During the puerperal state, the organs affected by pregnancy return to their pre-gravid condition, although they perhaps never entirely regain their former structure, at any rate that which they had previous to the first pregnancy. At the same time the changes produced in the organism as a whole by pregnancy and labour, also disappear.

But while the activity of the pelvic generative organs falls into the background, the breasts develop into functional organs, so as to provide nourishment for the new-born child. To a description of these processes we must add that of the early changes in the body of the new-born child.

Probably nowhere else do physiological and pathological phenomena verge so closely upon one another, as during the puerperal state. The rapid and important change in the circulation, indeed in the whole system, the entire transformation of a whole set of organs, the wounds caused by the act of parturition—in a word the radically different conditions of life, make it necessary to considerably extend the limits of health; the new state of things brings with it a condition which eminently predisposes to disease. This in itself is sufficient reason for carefully watching every puerperal woman, and for studying the characters of the normal puerperal state. We must regard it as normal, so long as we only find phenomena which are necessarily connected with and consequent upon involution, and when the puerperal woman both subjectively and objectively appears to be doing well.

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1. *The Changes in the Maternal System.*

a. Involution.

§ 212. The severe exertion of labour is immediately followed by an agreeable repose; the sensation of chill which so often accompanies the emptying of the uterus (*cf.* § 149) by a sense of warmth, by perspiration and a feeling of great relief, and as a result of the fatigue sleep comes on from which the woman wakes up refreshed.

The *temperature of the body* is on an average somewhat higher than is usual in healthy persons. During the first 2—3 hours after the labour, it remains at the same level that it had immediately after it; only when the rise was unusually great, does a fall take place. Within the first 12 hours it then usually rises a little, and may reach as high a level as at any time during the course of childbed; this elevation is partly to be attributed to the physical exertion of labour and to the psychical excitement. During the second 12 hours, the temperature again falls, and this fall is especially marked, when the temperature is taken during the morning remission. The fall, with very slight oscillations corresponding to the evening and morning variation, is maintained during the second 24 hours, giving way on the third day to another slight rise, which as a rule corresponds with the development of lactation. This rise lasts for a couple of days, and from the sixth day onwards makes way for the ordinary temperature. The subsequent temperature of lying-in women is somewhat higher than that of perfectly healthy persons, but the increase is inconsiderable (38° C.=100·5° F. is the limit); indeed the variations are no greater than those commonly met with in the latter, and are liable to the usual diurnal oscillations. Owing however to the great sensitiveness of the body temperature of lying-in women, the maximum of ca. 38° C. (100·5° F.) is more often brought on in them by very trivial and frequently unaccountable causes, than it is in non-puerperal women. The average higher temperature is certainly due to a disturbance produced by he small wounds associated with labour, to the resorption of egeneration products formed in the generative organs, and to he irritation of the mammæ which accompanies the development f their secretion.

The *pulse* in lying-in women is generally slowed, and therefore s to some extent in contrast with the elevation in temperature. The pulse-rate, which had increased during labour, diminishes mmediately after it, then rises again, and on the second, third or ourth day becomes remarkably slowed. The rate then varies between 44 and 70, indeed a frequency of less than 40, even of 30, has been noticed; the usual figures are 44, 48 and 56. At the same time the beat is full and forcible, although according to the most recent observations (Fritsch, Löhlein, Meyburg) the arterial tension is not increased. This then cannot be the cause of the slowing; it is rather the mental and physical rest of the puerperal woman as well as a certain impoverishment of the blood due to its abundant losses, while but a sparing amount of nourishment is taken, that are to be looked upon as explaining the phenomenon, perhaps also some temporary disturbances of the nervous mechanism caused by the impoverishment. The retardation is more frequently observed in multiparæ than in primiparæ, and lasts also longest in the former; it lasts longest when most marked. The duration varies from 1—12 days, but on an average the normal rate is regained on the 6th or 7th day. The retardation is not much affected either by the degree of the involution of the uterus, or by the onset of the lacteal secretion, and is always a favourable prognostic sign. The pulse-rate does not by any means always run parallel to variations of temperature; for instance when the pulse in the individual is not readily affected, the changes in it always set in somewhat after those in the temperature, and this must be borne in mind in estimating their importance. Otherwise the variability of the pulse in lying-in women is very great, as a consequence of their usually highly impressionable condition. I may mention here that the *first cardiac* sound is frequently changed to a soft blowing murmur, probably also a consequence of disordered nutrition and innervation.

The *respiratory rhythm* is slowed, corresponding to the quiet condition of the lying-in woman, but presents no special characters. The capacity of the lungs is practically unaltered, as would be expected from the position of the diaphragm not being affected by pregnancy (*cf.* § 78); nevertheless owing to the greater range of movement of the latter after the emptying of the abdominal cavity, the capacity may appear to increase. The widening of the base of the thorax brought about by pregnancy diminishes, although it does not quite disappear, so that the previous narrow waist is generally lost.

§ 213. The *skin* increases in activity, and thus assists in eliminating the products formed by the retrogressive metamorphosis of the generative organs. Perspiration sets in very soon after the confinement; the body, if kept warm, perspires copiously during the first eight days, but even when it is cool the skin is always moist; this increased cutaneous activity, and with it a great susceptibility to changes of temperature, lasts for a long time, and is also found in suckling women. It is not uncommon for some of the hair of the head to be lost for a time, in consequence of the hyperæmia of the skin, and the accompanying exudation into the hair follicles. The deposits of pigment which were formed during pregnancy, disappear more and more, although as a rule never entirely.

The *secretion of urine* is increased even more than during pregnancy. The urine is pale and clear, with a specific gravity of ca. 1015. Since the absolute quantity of urea and sodium chloride eliminated is practically unaltered, while the phosphates and sulphates are diminished, a greater quantity of water must be got rid of; and considering the copious perspirations and the sparing diet of childbed, the quiet condition of the woman, the insignificance or absence of any diminution in the urea eliminated shows that in lying-in women oxidation products are largely excreted by the kidneys. The increase in the secretion of urine does not extend beyond the first eight days; the temporary diminution on the second to fourth day being associated with the commencement of lactation and profuse perspirations.

The urine is very frequently *saccharine;* the sugar is in the form of lactose, and as a rule contemporaneous with the establishment of lactation; its quantity is generally in proportion to the abundance of the milk. It soon disappears, when the formation and consumption of the latter are balanced; it reappears when the supply of milk decreases or entirely ceases, and when the breasts are not emptied. When the lacteal secretion is permanently arrested, the sugar also disappears from the urine. This lactosuria is, as I have for years been teaching, a resorption diabetes.

Retention of urine is sometimes observed in the first two to three days. It is caused by the capacity of the bladder being increased through the loss of the pressure which the pregnant uterus was exerting on it, and of an efficient abdominal pressure; sometimes it is due to a swelling or bend in the urethra. Occasionally the urine is not voided, because micturition is made very painful by a bruised, sore condition of the urethra, in which (especially at its so-called vesical portion) fissures are often produced during labour (dysuria).

The action of the bowels is sluggish, owing to the quiescent condition of the woman, the small amount of nourishment taken, the increased activity of the skin and the relaxation of the abdominal muscles. For the same reasons the appetite is poor during the first four or five days; thirst on the other hand is increased, in consequence of the greater elimination of water.

Inasmuch as the intra-abdominal pressure relations alter after labour, any *œdema and varices of the lower limbs* and possibly of the region of the hips, which might have been present before it, rapidly diminish; the œdema soon entirely disappears, but the varices are never completely lost. The *abdominal walls* appear greatly relaxed, and in the hypogastric region sometimes hang over sacciform; the areas in which the cuticle is thinned (striæ) remain as faded streaks. But by degrees the abdominal skin regains its elasticity, and gradually retracts towards the navel in a centripetal direction. Only after rapidly repeated labours is the elasticity permanently lost.

The retrograde changes in the generative organs, the copious discharges from them, the loss of material by the mammæ, the increased cutaneous and renal secretions, in conjunction with a sparing diet, lead to a *decrease in the total weight of the body,* which during the first eight days amounts on an average to 4,500 grm. (10 lb.), *i.e.* to about a twelfth part of the body-weight, and is in direct proportion to the size of the confined woman. This loss however is again made good in the course of a few weeks.

Lastly, it must be mentioned that the great *nervous irritability* which so often accompanies the advance of pregnancy, is very slowly lost; it is true that certain symptoms present during gestation often become less marked, but fresh ones are apt to appear, and the sensitiveness to impressions is, generally speaking, very great during childbed.

§ 214. The *uterus* ranks first in importance amongst the organs that undergo involution, much as it did when we described the alterations produced by pregnancy in the sexual system. Two processes affect it almost independently of each other, and run a symmetrical course—the diminution in its size and the reconstruction of its mucous membrane.

The *diminution in size* commences at the time of labour, and when this is concluded progresses under the same influences *i.e.* contractions, which are now termed after-pains. These soon lead to a permanent shortening and alteration in the arrangement of the muscular fibres; and since the muscle is now inactive as well as anæmic, the contents of the cells undergo fatty degeneration and absorption; the fibres disappear. The anæmia of the puerperal uterus is a natural result partly of an inactivity which increases day by day, in part of the compression of numerous (especially of the small) vessels by the con- or retracted uterine musculature. Whether fibres are entirely or only partly disintegrated, and if the latter, which portion remains, is not settled. The fatty degeneration is macroscopically most distinct from the fifth to the eighth day, least so in the cervical portion; during that period the uterus on section appears reddish-yellow or pale-yellow, and globules of fat visible to the naked eye may be removed from it; the texture is extremely soft and friable, and tears readily. A *new formation* is not distinctly visible till the fourth week, and appears first in the external layer of the walls, where also numerous nucleated elongated cells can be seen, which are about to develop into short fibre cells. It is very doubtful whether they are the result of a true new formation; these apparently newly formed cells are probably embryonic muscular elements which have been kept in reserve, which did not undergo hypertrophy during the previous pregnancy (*cf.* § 64), and therefore have not fallen a prey to the fatty degenerations of childbed. Thus disintegration and reconstruction take place hand in hand within the walls of the uterus, and the whole process is not usually completed till after eight weeks. Puerperal diseases have generally speaking no influence over it.

Other constituents of the uterine wall are destroyed beside the muscular fibres; especially a large portion of the vessels. The larger arteries are obliterated by a connective tissue hypertrophy of the intima, or at any rate become greatly narrowed by it; in the media also fatty degeneration takes place to some extent. Similar alterations affect the larger veins. The capillaries compressed by the muscular tissue, like it fall a prey to fatty degeneration; the sinuses and veins of the "placental site" are obliterated by thrombosis.

The last result of the involution of the uterus is its diminution in size. The organ which weighed about 1 kilo. (2·2 lb.) soon after delivery, two days later only weighs 750 grm. (26½ oz.), is 19—21 cm. (7½—8¼ in.) long and 11 cm. (4¼ in.) wide; its wall at the level of and below the fundus, especially below the oviducts, has a thickness of 3—4 cm. (1—1½ in.). At the end of the first week it weighs about 500 grm. (ca. 1 lb.) and is 13—16 cm. (5—6¼ in.) long; after fourteen days its weight is about 350 grm. (12¼ oz.), its length 13 cm. (5 in.), its thickness 1 cm. (ca. ½ in.). These of course are only average measurements, and are subject to considerable variations. After six weeks the uterus has nearly regained its previous size, although it always appears somewhat larger and more rounded than the nulliparous organ.

The *peritoneal lining* of the uterus can in virtue of its elasticity follow the retracting subjacent muscular tissue; in so doing it becomes thinner; its previously dilated lymph channels become narrower and less distinct. If in certain places the elasticity is wanting, the serous membrane is there found wrinkled and loose on the layer beneath it.

§ 215. The *reconstruction of the uterine mucous membrane* takes place in the following way. At parturition, the cellular layer of the decidua, with or without a portion of the areolar intermediate layer (*cf.* § 89), is thrown off with the placenta; the glandular layer remains behind, and with it sometimes also a thin lamella (varying in extent) of the cellular layer. The muscular tissue therefore is not laid bare, but on the contrary is covered by a layer of a yellowish-red or whitish substance, at least several mm. thick, which presents an irregular reticulated surface, and whose superficial elements are pushed apart by an abundant sanguineous infiltration. The same description holds good of the placental area, except that the yellowish-red layer

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is thinner, and that the exposed and thrombosed vessels lying here give to the surface a nodulated uneven aspect. The whole tissue is copiously infiltrated with round cells, the gland spaces are in part filled with blood, and the most superficial layer of tissue is in a state of fatty metamorphosis.

The wall of the uterus is covered and its cavity in part filled by a more or less thick layer, which consists at first mainly of blood, afterwards of blood-stained slime, and in which the morphological elements consist of blood, round cells, detached decidual cells undergoing fatty degeneration, and of the products of their disintegration.

Any remains of tissue which are still adherent, and are not required for the formation of the new mucous membrane, disappear by a process of fatty degeneration, and together with a serous transudation form the principal portion of the discharges from the uterine cavity (*lochia*).

By the second week the yellowish-red layer on the inner surface has become much thinner and looks like granulation tissue. The placental area is smoother than it was, some thrombi are detached, the remainder are smaller, firmer and somewhat discoloured; the lochia are thinner and paler. Any remaining shreds of tissue are now cast off; only here and there can decidual cells still be found, and these have undergone fatty degeneration. The glands, especially their fundal portions, lie quite exposed, since a portion of the glandular epithelium has also been shed; the gland ducts no longer lie so obliquely, so nearly parallel to the uterine wall as before. The inner surface of the uterus is now therefore in part covered by epithelium. The intermediate areas which are infiltrated with round cells are more and more encroached upon, the whole internal surface gradually diminishes, and thus the islands of epithelium derived from the fundi of the glands, are by degrees approximated to one another, till by a continuance of these processes, and by a further proliferation of the epithelium belonging to the portions of the glands that are left, the islands at length come into contact, and thus form an unbroken coating over the previously exposed surface.

By the third week the muscular wall is lined by a delicate smooth pale membrane, which is still covered by a copious, pale, yellowish slime. This membrane is the new mucous membrane consisting of a thin connective tissue layer, containing numerous lymphoid cells and some spindle cells (still in part undergoing fatty degeneration), and covered by a delicate epithelium. The epithelium is still absent from many parts of the placental area, especially from those where the thrombi were exposed. The epithelium gradually assumes the cylindrical form and becomes ciliated. By a proliferation of the interglandular tissue and by the mucous membrane becoming thicker, the shallow glandular recesses are elongated and stretched, and thus at last the mucous membrane regains its normal condition; last of all over the placental area. This process is as a rule complete by the fourth week; sometimes however the reconstruction takes place much more slowly, and occasionally for some months more, nothing but granulation tissue can be found on the uterine wall. Deposits of pigment usually lie free in the mucous membrane, and furnish an almost invariable sign of a previous labour; they are not found after menstruation, since the hæmorrhage accompanying it is superficial.

We do not as yet know how the mucous membrane is reconstructed in those cases where the whole decidua is discharged at labour (as doubtless occasionally happens after very difficult instrumental labours); probably under such circumstances merely a layer of connective tissue is developed from the underlying layers, which then becomes covered by epithelium derived from the neighbouring parts, no new glands being formed, since they could only originate from the epithelium of the surface.

The thrombi of the placental area (including those of the uterine sinuses) become organised in the usual way with the assistance of the walls of the vessels; indeed from and after the 8th month of pregnancy, a portion of the sinuses lying below the placental area is blocked by an accumulation of large multinucleated cells derived from the endothelium, and by coagulated blood. But the organised thrombi are very slow in shrinking, so that in sections of the uterus soft translucent spots corresponding to them may often be seen for some months.

§ 216. The *cervix uteri* soon regains its previous condition. Immediately after labour it is very soft and wide; the internal os uteri forms a broad swollen ring through which several fingers can be easily introduced. The canal is still long (averaging

7 cm. (2¾ in.) to the obstetrical internal os), and its mucous membrane is thrown into folds; the external os is patulous, its lips are bruised and not infrequently torn, especially at the sides. By the following day, after about 12 hours, the internal os has become narrower and more resistant; the whole cervix is smaller, its mucous membrane forms distinct prominent longitudinal folds. The cervix now rapidly grows smaller and narrower, and in 12 days after labour has almost regained the length of a fully involuted (4 cm. = 1½ in.) cervix, while the body of the uterus still lags far behind. The internal os will as a rule no longer admit the finger after the tenth day; the longitudinal folds of the mucous membrane have disappeared, or are quite insignificant. The portio vaginalis alone continues thick, and together with the external os remains patulous for a long time; the anterior lip especially appears enlarged, and very often presents erosions and granulations. The portio vaginalis is not fully involuted for several weeks, and indeed after the first labour it scarcely ever completely regains its virgin shape. No decrease in the thickness of the cervical walls takes place, inasmuch as they had been greatly thinned during labour.

The *broad ligaments, Fallopian tubes*, and especially the *round ligaments*, are affected by the involution processes to the extent to which they shared in the hypertrophic changes of pregnancy; the hyperæmia and turgescence of the pelvic connective tissue are specially slow to disappear, while the previous disposition and position of the ovaries and Fallopian tubes are not regained, till the diminishing uterus gradually sinks down into the pelvic brim.

The *vagina* usually continues wide, smooth, and irregularly swelled for some days after labour (only very rarely does the contraction and involution of its muscular wall cause it to be rapidly narrowed), and its lumen does not regain its non-puerperal condition till the 3rd or 4th week; only then does the columnæ rugarum again become distinct. The great prominence of the anterior wall, which sets in during pregnancy, and still more immediately after labour, disappears, although the structure of that wall generally remains looser and more elastic. The inlet is the first portion to regain its narrow dimensions, by the contraction of the muscles round it, although even it usually appears wider than in the nulliparous condition, in consequence of the tears that have taken place. The width and relaxation of the vaginal walls increase with every labour. The epithelium is regenerated, and any hypertrophy of the papillæ that was present, disappears, although perhaps not entirely.

At the *vaginal entrance* some small superficial abrasions can generally be found, these being of course commonest in primiparæ. In the latter the hymen is torn through in many places, especially along its posterior margin. These tears lead to the formation of small rounded flaps or of conical nipple- and tongue-shaped larger flaps, which vary in length, are placed on a broad base and are called carunculæ myrtiformes; the former variety are usually along the anterior, the latter along the posterior margin. The small thin flaps are merely due to tears passing through the edge of the hymen, the fleshy ones placed on a broader base to tears which have involved its attached border and the subjacent tissues. Occasionally parts of the hymen are missing, owing to the partial detachment of its attached border, and to the detached flaps having become gangrenous.

The *external genitals* gape for the first days after the labour, and have a bruised appearance; their inner surface is often excoriated, and the continuity, especially along their posterior margin, is often broken (frænulum). The nymphæ are the first to regain their previous shape; the labia majora before long come into contact, although they remain enlarged, but they never conceal the vestibule as completely as before; they gape longest near the perinæum. The latter begins to retract in the first 24 hours, and rapidly regains its former dimensions; this causes any existing wounds in it to become much smaller than they were directly after the passage of the child.

§ 217. The chief clinical features associated with the involution processes above described, are the perceptible *change in the size and condition of the uterus*, the *after-pains* and the *lochia*.

Immediately after labour, the uterus forms a firm mass which (owing to the laxity of the abdominal walls) can be easily grasped, is rounded, somewhat flattened antero-posteriorly, or irregular in shape, and lies between the navel and the symphysis. It is generally in the median line, but now and then inclines to the right, more rarely to the left side, and as a rule it is slightly twisted round its axis. Moreover it is moderately anteflexed, and may cause a slight convex projection above the symphysis.

The average elevation of the fundus above the latter amounts to 11 cm. (4½ in.), its greatest width is 10 cm. (4 in.), the length of the cavity from the edge of the anterior lip of the os uteri being 15 cm. (6 in.); in primiparæ these measurements are as a rule somewhat smaller than in women who have been repeatedly confined. If the bladder is distended, it forces the uterus away from the anterior abdominal wall and straightens it; at the same time it pushes it to one side, usually the right, and thereby increases its rotation round the longitudinal axis. It also pushes the fundus upwards, thus increasing its elevation above the anterior pelvic wall. The filling of the rectum has a similar, though less marked, effect in raising the uterus and displacing it to the right side; this explains the (apparent) enlargement of the uterus which is so often noticed some hours after a confinement. If met with in conjunction with an empty bladder and rectum, the enlargement is real, and must depend upon abnormal relaxation of the parietes, or in some cases on an accumulation of blood.

In perfectly normal cases, the size of the uterus existing at the time of delivery, begins steadily to diminish. The diminution is perceptible after 24 hours, a change in the elevation being easier to discover, and more distinct than one affecting the width. Just as the decrease in weight was the most considerable during the first 14 days, so also does the volume diminish most rapidly during the same period; these changes afterwards proceed much more slowly. By the third week the anteflexed uterine fundus lies behind the anterior pelvic wall, at any rate when no intestinal convolutions lie in front of it, as is very commonly the case when the body is erect; when it is higher, this must depend on the distention of the neighbouring organs. The cavity about this time is on an average 10 cm. (4 in.) in length.

§ 218. The diminution of the uterus during the first few days is due mainly to the *after-pains*, afterwards to the retrogressive metamorphosis of its elements. The after-pains are a continuation of the labour pains, like them are rhythmical, and can be recognised as contractions both by a palpating hand and by the lying-in woman. These contractions are always followed by a *tonic retraction*, which maintains the uterus in a condition not far from the maximum of contraction, and which must be clearly distinguished from mere elastic reaction.

The after-pains generally last for the first 4 days; in rare cases they last longer, but frequently only for 1 to 3 days. Their duration, frequency and severity are in inverse ratio to the duration of labour, and to the force of the labour pains; where labour lasted very long and the expulsive forces were very strong, they may be almost entirely absent; conversely, after an unusually rapid labour they may be very severe and proportionately painful. For this reason after-pains are as a rule much weaker in primi- than in multiparæ, and indeed the former may escape them altogether. The old adage of midwives that all women sooner or later suffer alike, represents therefore what is actually the case. It is natural that the after-pains should be specially severe and prolonged when the uterus has been greatly distended (*e.g.* by twins or excess of liquor amnii). The sucking of the new-born child almost invariably calls them forth by a reflex action. As long as they do not recur too often, are unaccompanied by fever, and the uterus is not sensitive to pressure during them (it must however not be forgotten that palpation may produce contraction, and thus be very painful), the after-pains must be regarded as a normal and very favourable phenomenon, by which the uterine vessels are firmly closed and the uterine contents expelled. But very severe and very painful after-pains always point to some irritation of the uterus, or to a pathological accumulation within its cavity.

§ 219. The *lochia* (*cf.* § 215) are derived from the blood contained in the uterine cavity, from the mucous membrane which is being superficially disintegrated and regenerated, from an exudation accompanying this process, from cervical secretions and from vaginal exfoliations. Accordingly, during the first few days they consist of almost pure *blood*, mixed with clots and shreds of decidual and sometimes fœtal membranes or even of placenta. After the third day the amount of blood diminishes, the lochia become pale, *serous*, and contain blood-corpuscles, pavement epithelial cells, also cylindrical cells from the cervix, mucus corpuscles and granules, aggregations of granules, and often still some remnants of decidua. The reaction is alkaline, the chemical constituents being albumin, mucin, saponified fat, and compounds of chlorine and phosphorus. From the 5th to 8th day the discharge is still thin, the blood-corpuscles continue to diminish, while the pus cells, granular cells and fat globules increase. During the second week the secretion is greyish-*white*, sometimes thick and viscid, sometimes creamy; its main component is pus, the epithelial cells have greatly diminished, and instead of them are found young spindle-shaped connective tissue cells which contain fat, free fat and crystals of cholesterin; the reaction is neutral or acid. Occasionally an infusorium, the trichomonas vaginalis, is found in the discharge; bacteria are present. The lochia steadily diminish in quantity, become paler and clearer, approach more and more to a non-puerperal secretion, and finally after lasting for a variable time disappear.

The composition varies with the condition of the internal surface of the uterus, of the cervix and vagina; there are numerous gradations between lochia serosa and l. alba seu lactea. Blood not uncommonly reappears at the end of the first and in the course of the second week, especially when the lying-in woman leaves her bed too soon. When no disinfective measures are used, the odour after the fourth day becomes very penetrating, and is due to a volatile acid; later on it rather resembles that of stagnant pus. It is only when the discharge from the uterus is not quite free and continuous, and when the secretion is retained in the lower portion of the vagina, that the odour is very fœtid.

The quantity of the lochia, as well as their duration, vary with the peculiarities of the individual, and with the condition of the generative system. In women who usually menstruate copiously, generally in multiparæ, in non-suckling women, after unusual distention of the uterus, and where its involution progresses but slowly, the discharge is copious, remains longer sanguineous, and extends over a longer period. The average quantity of the lochial secretion amounts (according to Gassner's investigations) in the case of the lochia cruenta from the 1st—3rd day to 1 kilo. (35¼ oz.), of the l. serosa from the 4th—5th day to ·28 k., of the l. alba from the 6th—8th day to ·205 k.; thus during the first eight days 1·485 k. are lost. In suckling women the total quantity amounted to 1·085 (38¼ oz.), in non-suckling women to 1·88 kgr. (66¼ oz.).

b. The Secretion of Milk.

§ 220. The *development of the mammary glands which began uring pregnancy* (*cf.* § 73), rapidly increases after delivery. n the second or third day of the post-partum state, a marked urgescence sets in, which is favoured by the stimulus of suckling nd by the emptying of the glands, but occurs even where this timulus is absent; it often develops suddenly in the course of a ay or a night. The breasts are full, enlarged and elastic, someimes hard and nodulated; the skin is tense, the subcutaneous issue of the areola slightly œdematous and very sensitive to ouch; the superficial veins are filled and shine through the kin. The axillary glands are swelled, and the lymphatics passng to them from the mamma can be felt as cords; pains run arallel with them to the shoulder and arm. This state of ongestion is not always so strongly marked, but is rarely quite bsent in the normal condition. Associated with it there is ften a general, sometimes a very considerable, state of excitenent, but there is no rise of temperature in lying-in women vhose generative system and mammary glands are healthy, or at nost the rise is very slight (amounting to ·5° C.). The swelling nd excitement usually pass away with a free perspiration and n abundant flow of milk within 24 to 48 hours; the mammæ ecome softer and less tense, and the secretion is now fully stablished. A constant flow of milk is henceforth kept up by he breasts being regularly emptied by suckling; this removes ny possible obstruction to the efflux of the milk, arising from a notor stimulation of the contractile elements in the lactiferous ucts, from an increased filling of the blood-vessels of the gland, nd from a relaxation of the musculature of the nipple and reola. The amount in 24 hours may reach 1,350 grm. = 47½ oz. Lamperrière, *Compt. Rend.*, 1850, vol. 30); Gassner found that he average quantity of milk secreted by three lying-in women luring the first eight days, amounted to 2·15 kgr. (76 oz.).

The *period during which milk is secreted* (lactation) varies reatly; constitution, mode of life and especially the state of ligestion and assimilation affect it. In a healthy condition with egular suckling, milk continues to be formed for 9—10 nonths; it then becomes scantier, its quality alters, and finally the supply dries up. By diligent continuous suckling however it can sometimes be prolonged for a much longer period, *e.g.* for 1—2 years. Menstruation is usually absent during lactation, although it is not rare for the menses to appear, indeed they sometimes recur at the proper time, after an interval of six weeks, and under otherwise healthy conditions no injury results either to mother or child. A fresh pregnancy may therefore set in during the period of suckling, and is not uncommon in very fertile women; in such a case however the secretion of milk usually dries up very quickly, although occasionally not for some months.

If a lying-in woman does not suckle, the milk flows out spontaneously for a short time, and may be very copious; but before long the gland returns to its quiescent condition through want of a stimulus to empty itself, and this is favoured by the free action of the bowels which generally take place. The parenchyma of the gland undergoes involution, the lobules become atrophied and condensed, and the connective tissue septa between them again grow thicker and poorer in fat.

§ 221. The *secretion* of the mammary glands during the first days after parturition does not differ materially from that which can be expressed during the last part of pregnancy, except in being more copious. It is a turbid, whitish, somewhat slimy fluid, alkaline in reaction, in which some yellow streaks and spots are plainly visible; it is called the *colostrum*. On the 2nd to 4th day the fluid increases in quantity, becomes of a lighter bluish-white colour, thinner and better mixed than before, the yellow flakes having disappeared. This is the true *milk*.

The colostrum contains morphological and chemical constituents, which are absent or at any rate much less abundant in true milk, viz. *colostrum corpuscles* and albumin. The structural bodies consist of small fat globules, free nuclei, and of cells of the size of a colostrum corpuscle, containing nuclei but with fewer fat globules. The corpuscles themselves are round mulberrylike bodies of variable size, consisting of a number of large and small fat globules which are held together by a hyaline connecting material, which swells up in acids or alkalies. They are undoubtedly cells; for on the one hand acetic acid or carmine pigment brings out a nucleus in them, and on the other hand under suitable treatment they possess amœboid movements and by means of them can expel fat globules. Only a certain number of colostrum corpuscles however exhibit this latter character, and it is an indication that changes in their constitution are in progress. As a matter of fact colostrum corpuscles are cells of the alveolar epithelium, which first become round, clear and faintly granular, then exhibit movements, and at last by means of them take up fat globules from the contents of the alveoli. We do not know why this change in the alveolar epithelium is practically confined to the early period of the glandular activity, and afterwards disappears or grows much less marked (Heidenhain).

True milk contains few colostrum corpuscles; the *milk globules* form its predominating constituent. These are bright globules of fat of very variable size, the smallest being almost too small to measure, the largest having a diameter of ·025 mm. (·001 in.); the common size is from ·002—·005 mm. (·00008—·0002 in.). These fat globules are a product of the secreting alveolar epithelium, *i.e.* of the gland cells (*cf.* § 57). Within the body of these cells, especially in their inner half, globules of fat are formed. The outer portion of the cell, together with the fat contained in it, is discharged during the secretion. The detached part of the cell dissolves in the milk, the fat globules being set free; a portion of the body of the cell may often be seen still clinging to them, but this too is by degrees dissolved. If nuclei are contained in the detached portion, they also pass into the secretion. The remainder of the body of the cell is then reconstructed, beginning in the outer portion, when the process which has been described, begins afresh. The more copious the secretion, the less filled are the cells; conversely, when the former is scanty, the latter are full and swollen. The formation of the constituents of the milk has therefore no resemblance to that of the cutaneous sebum, as was at one time almost universally believed. It does not depend on fatty degeneration of the cells (as occurs in the latter), but on a production of fat within the cells, while the latter are maintained.

The milk globules possess no external membrane, but are emulsified by the casein which is dissolved in the milk. The casein (like the gum used in the artificial emulsions of the chemist) produces the emulsion by forming a thin fluid pellicle round the fat drops; any treatment of the milk which causes the fat globules to run together or to be easily dissolved, acts by destroying these envelopes of soluble casein.

§ 222. In addition to fat, milk contains casein, traces of albumin, sugar, salts and gases. The amount of *butter* varies from 2·5—7·6 per cent., but rarely averages more than 3·5 per cent. It is derived from the albuminates of the food, and is for the most part formed in the glands, *i.e.* in the milk cells; a certain portion of the fat however (Voit, Heidenhain) probably passes straight from the blood into the secretion.

Casein is a potassium albuminate, which is not found in colostrum, but is derived from the serum-albumin in the mammary gland (it does not exist in the blood); whether the conversion takes place in the milk cells is still undecided, but it undoubtedly occurs in the fully formed secretion. The proportion of casein varies within small limits (about 1 per cent.), according to the state of nutrition, the maximum quantity being 4 per cent. Only traces of *albumin* are present; according to Hoppe-Seyler about ·4 per cent[1].

Milk-sugar is found exclusively in milk, and must therefore be formed in the mammary gland. The presence of sugar and starches in the diet appears to have no influence on its formation; albuminates therefore constitute its immediate source, and carnivora fed on a purely meat diet have a very considerable proportion of sugar in their milk. The quantity of sugar exceeds that of the fat and albuminate, is much more constant than that of the former, and amounts to 3·2—6 per cent.

The *salts* in milk consist principally of patassium, lime, chlorides and phosphates; they amount to about ·14 per cent. The *gases* amount to about 3 volumes per cent. (nitrogen, oxygen, carbonic acid).

According to 89 analyses by Vernois and Becquerel, milk consists of:

Water		88·9
Solid matters		11, viz.:
Butter	2·6	
Casein	3·9	
Milk-sugar	4·3	
Salts	·14	
	10·94	

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[1] Puls (Pflüger's *Archiv.*, xiii., p. 176) found ·95 per cent., in a lactation of 19 months' duration.

The variations from this average, as well as the total quantity, depend mainly on the nutrition of the mother, and on the duration of lactation. From this point of view the presence of albuminates in the diet is of the greatest importance; the more abundant they are, the more copious is the quantity, and the better is the quality of the milk; it will also be very rich in fats. During the progress of lactation, a gradual increase in the amount of albuminate shows itself together with a simultaneous decrease in the amount of fat and even of sugar; the amount of sugar and salts however is in most cases but little altered.

Various substances taken with food, such as colouring agents and the scented matters of numerous plants, pass over into the milk; amongst drugs, iodine, mercury[1], the alkaloids of opium, and salicylic acid[2], have been found in it. The influence of emotional disturbances on its formation is well known. If diluted with water, woman's milk becomes faintly bluish; the cause is unknown.

c. *The Diagnosis of the Puerperal State.*

§ 223. The signs that delivery has taken place at some previous time, are mainly those mentioned in § 136, where the diagnosis of a subsequent pregnancy was discussed. Those which indicate that *a confinement has recently taken place*, and that the puerperal state is still present, are the following:

The general condition is, as described above, that of a woman recovering from an illness. The breasts appear full, hard, nodular, and often tense, their pigmentation and secretion are very noticeable, the latter being so both in respect of quantity and quality. The abdomen is slightly tympanitic, its walls are relaxed, the skin moves freely over the underlying muscles. The uterus feels enlarged and like a ball lying beneath the abdominal walls; the cervix uteri is soft and broad, wide below, but contracted above like a funnel; its lips are bruised, and not infrequently present fresh and deep lacerations. Through the anterior vaginal fornix the body of the uterus is felt as a heavy super-incumbent mass, which can however readily be moved, and has a bulging anterior wall; it contracts on firm pressure, especially on bimanual examination. The lochial discharge (*cf. supra*) flows from the os uteri. The vagina is wide, its walls lax, the columna rugarum is absent. The external genitals are still swollen and bruised, the hymen is torn, its fragments are congested; erosions and small tears will usually be found granulating. The perinæum is discoloured and very elastic, and lacerations are especially common in its vicinity. The perinæal portion of the vaginal entrance gapes most freely; there too the mucous membrane is most injured and much smoother than before.

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[1] *Cf.* Klink, *Vierteljahrsschrift für Dermatologie*, iii., p. 207.

[2] Pauli, *Dissertation.* Berlin, 1879.

§ 224. If all or most of these signs are present, especially if they are evidently of recent origin, the diagnosis cannot be doubtful. Such will be the case during the first ten days, for there is no other condition which would produce even an approximate aggregate of those signs. In case of doubt, the changes in the breasts, perinæum and vaginal orifice, and those in the uterus are the most reliable. Mammary secretion may indeed occur in the non-puerperal condition, but the quantity and composition of the fluid secreted in such a case, are entirely different, and on the other hand the breasts of a recently confined woman are scarcely ever quite empty and soft. The vaginal orifice, the vulva and the perinæum may be stretched in surgical intra-vaginal operations, but, apart from the fact that in such circumstances an opinion as to what has caused the signs, is scarcely ever required, such stretching is very different, and the tissues have an entirely different appearance to that seen in the puerperal state. Enlargement of the uterus is of course a common occurrence, as well as dilatation of its cavity; but the softness of the tissues characteristic of the puerperal state is absent in all pathological conditions, and so also is the *gradual diminution in size*. The latter feature is the most important diagnostic sign of childbed, especially when it can be ascertained from day to day by bimanual examination and by the sound. It is of course true that involution and diminution of the uterus may follow upon the expulsion or extraction of pathological contents, but they then take place much more rapidly and vigorously; the process is never so regular or prolonged as in childbed.

The above brief description of the various phenomena will make it evident that the signs of childbed only attain their full value, when compared with one another, and when the morbid conditions which produce similar phenomena are eliminated. It will further be clear that they are only reliable during the first 14 days, and this period of time coincides with that during which the progressive diminution of the uterus can still be made out. After that period the diagnosis becomes more uncertain, and it is especially difficult to determine the date of the labour that has taken place. During the first 14 days the date can be fixed with a moderate degree of accuracy by the progress in the retrograde changes of the external organs and of their injuries, and especially by the size of the uterus.

When a later, and of course a mere anatomical, diagnosis of "parity" has to be made, the changes (*cf.* §§ 214 and 215) in the larger vessels of the uterine walls, and especially those in the sinuses of the "placental area," are of importance; so also is the deposit of pigment over that area of the uterine walls (*cf.* Williams, *London Obstetrical Transact.*, xx., p. 172; and Balin, *l.c.*).

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2. *The New-born Child.*

§ 225. As a rule the placental interchange of substances ceases, and the first sense of a want of breath sets in at about the time that the fœtus is expelled from the parturient canal, the slight variations in the moment of the first inspiration depending (*cf.* § 161) on the special conditions of the labour, and on other secondary influences. When vigorous children are born soon after rupture of the membranes, and with the expenditure of but little force on the part of the uterus, and when the detachment of the placenta and the squeezing out of the contents of its blood channels towards the child's heart do not follow immediately on its exit, the apnœa of intra-uterine life may persist for one or two minutes after birth; this apnœa may also be unusually prolonged in those cases *e.g.* premature births, in which the irritability of the nervous centres is but slight, owing to imperfect development.

The first respiratory movements lead to an enlargement of the thorax; the lungs consequently expand and cause the pulmonary alveoli to open up and fill with air, their capillary system being extended and widened[1]. The resistance which the pulmonary arteries previously presented has now disappeared, and as a result a great quantity of blood (probably mainly derived

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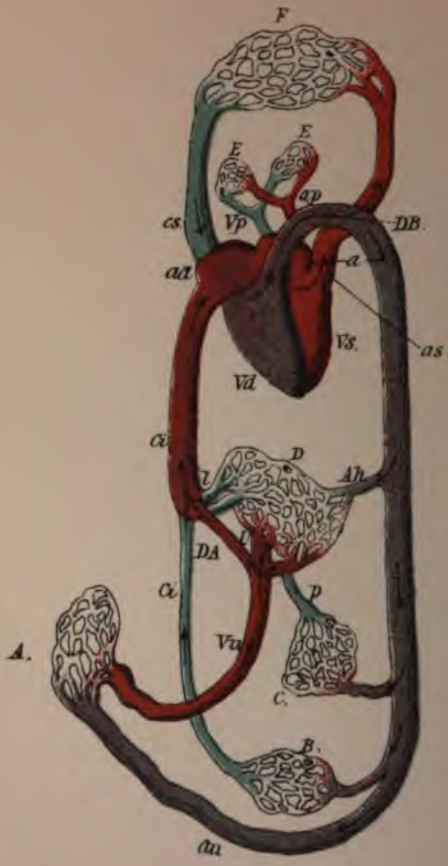
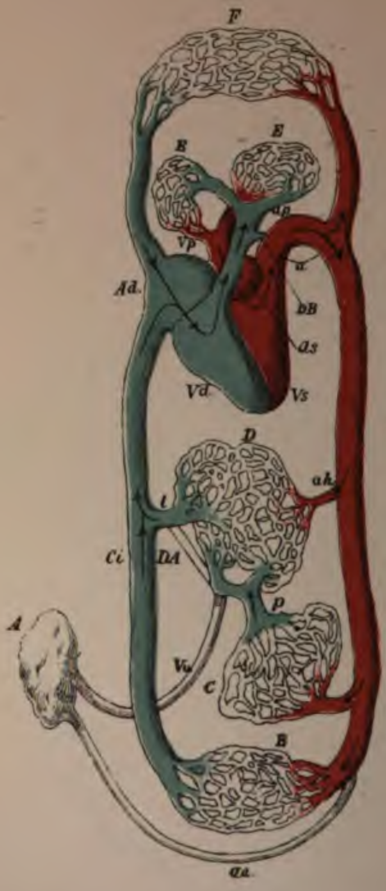
[1] The first inspiratory movements cause the ribs to be so much raised, that they never return to their old position during expiration. When once inflation has taken place, the force of elasticity is no longer sufficient entirely to expel the air. The thoracic aspiration will of course depend on the extent to which the ribs continue raised. (*Cf.* Bernstein, Pflüger's *Archiv.*, vol. 17, p. 617; Hermann, *ibid.*, vol. 20.)



A. Placenta.
B. Posterior vascular sy
C. Intestine.
D. Liver.
EE. Lungs.
F. Anterior vascular sy
DA. Ductus venosus Aran
vu. umbilical vein.
l. superior hepatic veins.
l'. inferior hepatic veins
p. vena portæ,
Ci. Vena cava inferior.
Cs. Vena cava superior.
ad. right auricle.
as. left auricle.
vd. right ventricle.
vs. left ventricle.
ap. pulmonary artery.
vp. pulmonary vein.
ah. hepatic artery.
au. umbilical artery.
a. aorta.
DB. Ductus Botalli.

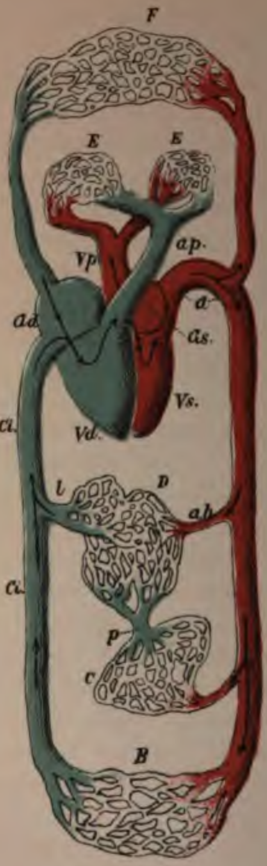
Fig. 58.—Fœtal circulation. (From the description of Professor Hasse, dra H. Strasser.)

Red=arterial blood. Violet=mixed blood. Blue=venous blood.



A.	Placenta.	
B.	Posterior vascular system,	
C.	Intestine.	
D.	Liver.	
EE.	Lungs.	
F.	Anterior vascular system.	
p.	Vena portæ.	
l.	Hepatic veins.	
vu.	Umbilical vein	Obli
au.	Umbilical artery	
DA.	Ductus Aranzi.	
DB.	Ductus Botalli.	
Ci.	Vena cava inferior.	
Ad.	Right auricle.	
Vd.	Right ventricle.	
As.	Left auricle.	
Vs.	Left ventricle.	
a.	aorta.	
vp.	pulmonary vein.	
ap.	pulmonary artery.	
ah.	hepatic artery.	

Fig. 59.—Circulation in the new-born child. The fœtal channels are becoming terated.
The arterial blood is not yet quite pure. Red=arterial blood. Blue=venous bl



B. Posterior vascular system.
C. Intestine.
D. Liver.
EE. Lungs.
F. Anterior vascular system.
p. Vena portæ.
l. Hepatic veins.
Ci. Vena cava inferior.
Ad. Right auricle.
Vd. Right ventricle.
As. Left auricle.
Vs. Left ventricle.
a. aorta.
vp. pulmonary vein.
ap. pulmonary artery.
ah. hepatic artery.

Fig. 60.—Circulation in an adult.
The colours denote the same kinds of blood as in fig. 59.

from the "reserve blood") rushes from the right ventricle past the orifice of the duct of Botallus into the pulmonary channels; that duct being no longer filled, becomes contracted. The arterialised blood returns by the pulmonary veins to the left auricle and greatly distends it; and since considerably less blood is meanwhile entering the right auricle (for the umbilical vein no longer conveys any blood), the blood-pressure sinks in that, while it rises in the left auricle. Both auricles therefore become equally filled; the current through the foramen ovale ceases, and the orifice gradually closes. The reflux from the left into the right auricle which might result from the higher pressure in the former, is prevented by the disposition of the valve of the foramen ovale (*cf.* § 112). As the work done by the right ventricle ceases to affect the descending aorta, the force of the current in the latter naturally diminishes greatly, and is no longer able to maintain the circulation in the long umbilical arteries; these therefore immediately after birth become greatly contracted, and the posterior portion only of their trunk remains patent, *i.e.* that which has an outflow through one or more collateral branches in the wall of the bladder (superior vesical artery). The umbilical vein and the ductus venosus Aranzi being no longer fed, likewise contract, and are emptied of the blood contained in them in the direction of the thorax by the force of aspiration (*cf.* figs. 58, 59, and 60).

The *obliteration of the fœtal channels* takes place in the following way. The ductus arteriosus Botalli collapses after being emptied, is pushed aside and bent, as a result of the expansion and displacement of the pulmonary branches to the right and the left, and of the heart changing from a horizontal to a more vertical position; these influences, assisted by a hypertrophy of connective tissue commencing in the intima, lead to its obliteration. The duct is converted into a fibro-elastic cord (ligamentum arteriosum), which very frequently retains a small lumen. The umbilical arteries become contracted and thrombose from the umbilical ring to the commencement of the posterior portion of their trunk already mentioned, and are converted into a solid cord (ligamentum vesicale laterale). The vein and its continuation, the ductus venosus, are emptied by aspiration, and collapse; and since no more blood is supplied to them, and the intra-abdominal portion together with the duct of

Aranzi is flattened by a descent of the diaphragm and of the liver, their walls remain in contact, and the vessels are obliterated by an agglutination of the layers of endothelium. Thrombosis is pathological; a persistent patulous condition is extremely rare[1].

Owing to the additional supply of blood brought by the pulmonary veins, and to the arrested influence of the right side of the heart upon the current in the aortic system, an eccentric hypertrophy of the left side of the heart takes place, so that by degrees the normal difference in size of the two halves of the heart is brought about. This hypertrophy extends even to the muscular bundles of the valve of the foramen ovale, and assists considerably in the obliteration of that foramen.

§ 226. The *remnant of the umbilical cord* dries up from the divided surface towards its origin at the navel; it turns brown, becomes flattened by pressure, and falls off as a rule on the fourth or fifth day, sometimes later. In rare cases detachment occurs before the fourth day; sooner in strong healthy children than those that are weakly and premature. The line of demarcation is formed by the edge of the circle of capillaries derived from the abdominal skin (*cf.* § 98); the dead remnant there gives rise to an irritative inflammation, by which it is entirely detached. At this spot the skin contracts in a somewhat circular manner, and after the detachment a small sore remains, resembling an ordinary flat superficial scar which is on the point of closing. It continues to discharge a day or two, then dries up and healing is complete. If the circle of capillaries is placed low down, the navel will be depressed; if very high, the navel will project.

The *sero-sanguineous swelling* of labour disappears very quickly, usually within 24—48 hours; although in very severe cases the affected area may continue red and sensitive for somewhat longer. The *moulding of the head* during labour disappears as the original fœtal shape returns, the rapidity with which it does so varying with the degree to which the bones were displaced and compressed. Such moulding usually disappears entirely within two or three weeks, a true tocological shape persisting only in very rare instances. The shape of skull peculiar to the individual gradually becomes apparent, although it was of course settled and prefigured in the original development of the fœtus[1].

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[1] *Cf.* Baumgarten in *Med. Centralblatt*, 1877, p. 721.

§ 227. Soon after birth the *intestine* becomes functional, its first action being to expel a large portion of the meconium filling up the colon. In a couple of days the evacuations become more fæcal, varying according to the kind of the food that has been taken. The mother's milk is the only *natural food* for new-born infants. It is especially rich in those substances which are necessary for the first of those metabolic processes, which are about to develop step by step, and is therefore best fitted to compel the tender growing organism to take up in the normal way all the various substances necessary for its tissues and fluids; it alone requires in order to be digested neither a prolonged sojourn in the stomach, nor any special mechanical force beyond such as can be furnished by the stomach while its muscle is still weak. When active assimilation has once started, the secreting apparatus of the stomach and intestine become functional, both are filled with gases, and the stomach passes from its originally vertical into the transverse position. The entire abdominal cavity enlarges, its vessels become fuller, and convey more blood to the liver for the formation of bile.

All the *digestive ferments* are, generally speaking, present in the new-born child. Pepsin is specially constant in the stomach, its formation beginning at the 3rd—4th month of fœtal life, and being connected with the development of the gastric glands, whose activity therefore is moderately great even in new-born children. The acid of the stomach however is absent during the later months of fœtal life, although present in new-born children; the formation of trypsin begins in the fœtus at the 5th month. The parotid contains ptyalin, but in the submaxillary gland this ferment is not found till later; as yet an infusion of the pancreas contains no sugar-producing ferment, although it is able to digest albumin and to decompose fats.

The *renal secretion* is copious, and contains all the principal constituents of urine. The urine is pale, dilute, with an average specific gravity of 1006 and an acid reaction; albumin is rarely present and only during the first days; never in healthy children. The urine even in the first days often soils the child's linen with a yellowish-red powdery deposit, consisting of urates which previously filled the straight uriniferous tubules (*uric acid infarct of the kidneys*), and have been washed away by the urine. Their formation depends on the greatly increased, though not perfect, combustion of albuminates.

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[1] *Cf.* Hecker, *Arch. f. Gyn.*, xi., p. 348; Rüdinger, *Beitr. z. Anthropologie &c. Bayerns*, 1877, vol. i., p. 286.

§ 228. At birth the skin of the fœtus is exposed to very different conditions from those *in utero*. It loses its vernix, turns very red, and usually on the third day its *epidermis begins to desquamate* (constituting a physiological pityriasis). The desquamation is in most cases branny, though the squamæ may form shreds or lamellæ; both varieties occur in perfectly healthy children, but in my experience the exfoliation of very large lamellæ is commonest in diseased children, and especially in children of diseased mothers. The desquamation begins on the anterior surface of the trunk, then spreads to the lower extremities, then to the face, and last of all (but not always) affects the upper limbs. Its duration varies greatly; in most cases the process terminates in 5—7 days, but it is not rare for it to last a fortnight. It persists longest where it appeared latest, *i.e.* on the face. On cutaneous surfaces which look towards each other, the desquamation not uncommonly leads to intertrigo; the scrotum sometimes loses the whole of its epidermis, since owing to the incessant moistening by urine, the regeneration takes place but slowly. As long as the desquamation lasts and especially during the first period, the skin is very hyperæmic and has a deep red colour; this by degrees passes into a light yellowish-brown tint, and may be mistaken for a slight icterus. The skin only assumes the proper flesh colour when the desquamation has terminated. New-born children perspire readily and freely, especially after the first three days of life; sudamina are very apt to form. The inflammatory swelling (so common in both sexes) of the small *mammary glands*, or rather of their rudiments (for at this early period there are only the main ducts with a few dilated offshoots), is to be looked upon as a consequence of the cutaneous hyperæmia. Those glands become red and sensitive to pressure, and a serous milky or colostrumlike secretion (called by the Germans witches' milk) can be squeezed out; it is more abundant in vigorous than in weakly children, and may be absent in the latter. This turgescent and irritable state passes away in a couple of days without further consequences, though injudicious manipulations may cause a suppuration of the rudimentary glands.

The majority of new-born infants (about ⅔rds of the whole number, especially weakly and premature children, and those of primiparæ somewhat more often than those of multiparæ) show during the first week a true *icterus* of variable intensity, which as a rule begins on the second or third day, and in most cases has disappeared by the 6th—10th day. Sometimes however it does not terminate till the 2nd or even the 3rd or 4th week; or else after lasting several days and entirely disappearing, a short relapse takes place. The children are as a rule perfectly well during the attack, drink and pass fæces, which considering their nourishment are normal. Only in severer cases do they appear to suffer or to be somnolent; at first they waste considerably, and afterwards make up for it very slowly, if at all. Simple icterus is therefore almost a physiological phenomenon and requires no special treatment, though it will be well to see that the bowels act freely and that the skin is well cleansed. The *causes are obscure*. The view (Frerichs) that a diminished fullness of the capillaries of the hepatic parenchyma consequent on the arrested afflux through the umbilical vein and on the developed pulmonary circulation, causes more bile to pass into the blood is as yet no more than a hypothesis; nor is there much probability in the theory that a congenital narrowing of the terminal portion of the bile-duct, or possibly a sluggish peristalsis of the latter in view of the thick copiously secreted bile, prevents its complete escape and thus leads to its resorption (Kehrer). It is much more likely that the *ordinary icterus neonatorum is usually caused by the blood*. Zweifel believes that the icterus arises through the blood exuding from the vessels of the skin, and through the colouring matters of the blood being set free; Porak takes the view that the surplus red corpuscles in the blood are destroyed, while the colouring matters from them are set free. In favour of these views are the absence of bile-pigment in the urine of the jaundiced infants, and on the other hand the occurrence of crystals of bilirubin in their tissues (Orth), and of similar substances in the urine (Parrot and Robin); bilirubin and hæmatoidin being in all probability identical pigments. Porak's view seems to me to be better supported than that of Zweifel, inasmuch as the changes which favour the extravasation of blood under the skin (ecchymoses) in the latter, have not been observed in the jaundiced new-born children, and since the sclerotic also is coloured yellow. The wholesale destruction of red blood-corpuscles is however undoubtedly due to the over-distention of the vessels of the child with the blood which should have been lost with the placenta and umbilical cord, a view which does not favour the practice recommended by so many, of forcibly squeezing the placental blood into the new-born child (*cf.* § 196).

It is a curious fact that icterus often somewhat delays the onset of desquamation, the latter only becoming fully developed as the yellow coloration diminishes or disappears.

The *production of heat* in the newly-born babe is scarcely sufficient entirely to make good the loss which, as the fœtus passes out of the maternal body into a medium which is nearly 20° C. (36° F.) colder, results by radiation and conduction through the air, and by means of the evaporation from the surface of the very moist skin. The temperature of the babe therefore, though rather higher than that of the mother immediately after birth, very soon becomes lowered. This fall may be very important in premature and weakly children, and indeed the temperature may sink far below that which is usually considered as the minimum under normal conditions. Happily new-born children bear such a fall better than older individuals, and an excessive fall is almost always guarded against by artificially preventing the loss of too much heat, and also by warming the child; if a proper amount of nourishment is taken and respiration is free, it is not usually long before the young organism loses the disposition to a fall of temperature and becomes able to produce sufficient heat for itself.

§ 229. All new-born children *lose in weight* during the first three days. This is due to the altered conditions of life which have followed on delivery, to the small amount of nourishment taken during the first few days and especially to the abundant discharge of meconium and urine. This physiological atrophy can be greatly lessened, although not altogether prevented, if the cord is not ligatured too soon, and if the mother and indirectly therefore the child are suitably nourished, granting the conditions to be otherwise healthy. The total decrease averages 220 grm. (7¾ oz.) and lasts for about 3 days, when the new-born infant begins to make good the loss by a gradual increase; the original weight is often regained by the 5th day, but generally by the 7th or 8th day; after this the gain in weight continues, slowly at first, more rapidly after three weeks. The children of primiparæ during the first two days show a greater loss in weight than those of multiparæ, and the latter also develop more regularly and rapidly than the former; the age of the mother has an influence similar to multiparity. Whether sex has any influence on the date of the commencement and the rate of growth is undecided. It is easy to understand why hand-fed children lose weight for a much longer time, and afterwards grow much more slowly than those nursed at the breast.

§ 230. The mental activity of the new-born babe is still on a very low level; the organism is governed by its spinal cord, as Virchow has well remarked. It feels and moves unconsciously, either in a reflex manner or spontaneously (Preyer), possibly also instinctively (*i.e.* guided by an inherited memory), when such a movement as that of suckling is executed with a definite purpose. Volition is still dormant; the inhibitory centres are as yet undeveloped, hence the freer scope for reflex activity, for hyperkinesia; hence also the liability to convulsions (Soltmann). Reflex actions which are executed as a result of experience, *i.e.* through intervention of the brain, are absent, *e.g.* closure of the lids when the surface of the eye is touched.

Tactile sensations and the sensitiveness to temperature are very feeble; sensitiveness to pain also is little developed and the muscular sense is slight. The sense of taste appears to be the most acute (Kussmaul), for the baby can distinguish the various sensations connected with it, and its mouth is thrown into the usual contortions. The perception of odours can scarcely be distinguished from taste, so that that sense must also be present at an early date. Light is undoubtedly perceived after a few days of life, for new-born children soon turn their head towards luminous objects. They next begin to stare at things, an act which is often mistaken for vision, but it is not till the 3rd—6th week, often still later, that the children begin to fix bright, shining objects. The sense of hearing remains longest dormant during the early period of life.

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3. *Management of the Puerperal State.*

a. Care of the Lying-in Woman.

§ 231. I need scarcely point out after what has been said above (*cf.* § 211), how important it is for the lying-in woman that she be properly treated, and what constant unremitting care she requires from her medical attendant.

When the recently confined woman has been cleansed in the way described in § 199, and her bed &c. has been arranged, she may quietly allow herself to fall asleep; but she must still be watched. The nurse should note the condition of respiration, the temperature of the skin and the expression of the face, and every now and then satisfy herself of the retraction of the uterus by laying her hand on the hypogastrium, so that any post-partum hæmorrhage may be at once discovered. The lying-in woman must be daily visited, as long as she remains in bed, even if she be quite well. The clinical phenomena of involution should be looked for at every visit, especially the state of the breasts, but no vaginal examination is to be made, unless called for by definite symptoms, since the accoucheur might even now convey infection or mechanically irritate the genital canal. If such an examination has been made, the vagina should be irrigated with tepid 2 per cent. carbolic water. The pulse and especially the temperature are our best guides in prognosis. If they remain within the normal limits, the accoucheur may rest content, for any illness will be at once signalised by changes in them, especially in the temperature—reason enough for carefully noting their condition at each visit, or what is still better, for allowing the nurse to take and record them regularly morning and evening.

§ 232. The lying-in woman should as a rule keep in bed for the first 8—10 days, though if she is quite well she need not adhere slavishly to this direction, but may for a short time leave her bed even at the end of the first week; but she must never before its termination walk about or undertake domestic duties, even in her own room. It is partly through disregard of this rule that subinvolution and displacements of the uterus and vagina are so common, since the attachments of these organs are still soft, relaxed and yielding during the period mentioned; this is especially true of multiparæ. Observations pointing in an opposite direction made in so-called barbarous races, and frequently also in women belonging to the labouring class, cannot be looked upon as in any way representing what is normal; they only show that where the constitution is healthy and robust, it is possible to run greater risk without harm resulting, than is desirable as a general rule. A healthy lying-in woman however must not keep her bed continuously for more than ten days; apart from the prejudicial effect of prolonged repose on digestion and assimilation, it may through insufficient muscular activity lead to thrombosis in the lower extremities.

The woman should at first only leave her bed for an hour or two; then for a little longer, and thus gradually resume her habitual activity in the house. After three weeks she may go out, while still avoiding any excessive activity and exertion. The *abdominal binder* which was applied soon after labour, should be worn for a considerable time longer; it affords some protection against persistent flaccidity of the abdominal walls, and gives support to the whole abdomen.

Her *bed* should be convenient and such as the woman is accustomed to, but above all it must be kept clean; the under sheets must be removed once or twice every day and replaced by fresh ones. Clean bed linen is only to be used after having been properly warmed, so as to get rid of any moisture left "from the wash." It matters not how the woman lies, so long as there are no special conditions (*e.g.* ruptured perinæum) requiring a particular posture. Her *clothing* must not be too warm, indeed in view of the great liability to perspiration, a light covering is to be preferred to numerous wraps. The bad practice, which is still so prevalent, of not allowing the lying-in woman to perform even the slightest toilette, doubtless arises from the common notion that the puerperal state is a severe illness. This view must be combated in the interest of the woman, and she may be allowed (contrary to the usual advice) to do her hair every day, provided that she does not exert herself too much; slight powdering of the hair prevents it from getting matted.

The *external genitals* must be washed several times a day with soft napkins made of old linen (not with sponges) and dipped in tepid water, and a warm linen cloth (diaper) should then be laid in front of them to catch the discharge; if the parts are much bruised and tender, they should be bathed for the first two days with cold water lotions; if they begin to swell, aromatic water should be substituted. Vaginal irrigations must not be used except where there are definite indications, and only when ordered by the physician; their abuse by midwives and nurses frequently leads to irritation, abrasions and even to infection.

The ordinary hygienic rules hold good for the management of the *bed-room* of the *lying-in woman.* It must be kept extremely clean and aired at least twice a day; nothing is more disagreeable than the air of a room which is constantly kept closed, and from which light is excluded. In warm weather one window at least may remain open during the day, and in winter this should be done at any rate at intervals; care must of course be taken that the lying-in woman is not exposed to any current of cold air. The results of well managed lying-in institutions show what a beneficial effect good air and light have on lying-in women and new-born children.

§ 233. It is a good plan at an early period to *get the bowels to act freely*, for during the first few days they are always obstinate; indeed this matter should be attended to on the day after the confinement, and not merely when swelling of the breasts and a febrile condition appear to demand it. Many slight ailments, such as severe after-pains, difficult micturition, dyspepsia, may be prevented by an early evacuation of the bowels. Enemata should not be used, since, as the lower portion of the intestine is usually empty, they only operate indirectly and therefore for the most part imperfectly. Nor must it be forgotten that they are apt to irritate the anus and rectum. Castor oil is the best laxative, but when it cannot be taken Epsom salts or St. Germain's tea &c.[1] may be substituted according to preference. Slight diarrhœa should not only not be feared, but is generally very useful, though of course it must soon be checked.

The *evacuation of the bladder* demands equal if not even more attention. A desire to pass water should never remain unrelieved, and on no account should undue distention of the bladder be permitted. Sometimes warm fomentations, or warm aromatics rubbed on the hypogastrium facilitate spontaneous micturition; but if there is much delay, the catheter must be used. Its introduction must be effected so as if possible not to introduce any air (a finger being applied to the opening and the

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[1] St. Germain's tea=

Senna leaves grm. ij. (grs. 30).

$$\left.\begin{array}{l}\text{Elder flowers}\\ \text{Aniseed fruits}\end{array}\right\}\text{aa. grm. j. (grs. 15).}$$

$$\left.\begin{array}{l}\text{Fennel fruits …………}\\ \text{Acid tartrate of potash}\end{array}\right\}\text{aa. grm. ss. (grs. } 7\tfrac{1}{2}\text{).}$$

Mix, and infuse in a cup of boiling water. (Tr.).

catheter being withdrawn before the bladder is completely emptied), or secretion from the genital tract. If the catheter cannot be rapidly introduced without the help of vision, the urethral orifice should first be exposed, so that the instrument may at once enter the bladder without lying in contact with the secretions. The catheter must of course be perfectly clean and previously disinfected with carbolic oil; metal ones are therefore as a rule to be preferred to elastic.

The *diet* must be light and digestible, and during the first two or three days an ordinary fever diet may be allowed. After that period meat broths, milk puddings and soon also roast meat, eggs &c. are to be given. It is a bad practice to allow healthy lying-in women to fast long; they need to be well fed, and if the appetite is good they may be encouraged to eat, bearing in mind of course the necessity of their keeping quiet and the condition of their digestive organs. Non-suckling women must as a general rule be kept on lower diet during the first 10 days than those that are suckling; the latter should be well nourished from the very first, this being desirable for the sake of their infants. Water is the best beverage, and a little of it may be aërated; too much tea, especially that made from lime-flowers or balm, of which officious midwives and nurses are so fond, is to be avoided, since lying-in women are so liable to perspirations. Weakly women may be allowed wine and light beer, after they have left their bed.

§ 234. It is the duty of every healthy and otherwise competent mother *to suckle her own child;* she owes this to her infant, to herself (the beneficial influence of suckling in promoting involution is in itself sufficient reason), and to the child which will be neglected by her wet-nurse if she engages one. The medical man however often preaches to deaf ears in reference to this matter. Some women will not nurse on account of the inconvenience it causes, or from a usually groundless apprehension of fading prematurely. Others are unable to nurse for social and especially business reasons, they are too closely connected with their husband's business to have sufficient leisure for nursing.

But a great many women *must not nurse because they are unfitted* for it. To this class belong all those who have too little or no milk, those suffering from galactorrhœa, those whose nipples are too flat and low, or too little developed, or depressed (*i.e.* below the level of the craterlike areola), those women too whose nipples are easily injured and sore. Unserviceable nipples cannot be improved, and all attempts to do so uselessly torment both the nursing mother and her suckling babe.

Amongst the diseases which prohibit a woman from suckling are great anæmia and wasting, phthisis and any hereditary tubercular diathesis, recent syphilis, epilepsy, severe hysteria or other neuroses, or an inherited liability to them. Women especially who are descended from families in which phthisis occurred, are to be strictly forbidden to suckle, since suckling is very apt to develop the dormant germ of the disease; this applies still more forcibly to women in whom there are already suspicious signs of the disease, such as prodromal catarrhs. Syphilis of long standing is not a contra-indication to suckling, since the child has already been infected *in utero*, and the mother's milk can therefore do it no further harm (indeed it affords us a means of administering anti-syphilitic remedies, *e.g.* mercury, iodine); further, the child would not do so well on other nourishment, and might infect a nurse. It is different where the *syphilis* in the mother is *recent* and has been contracted but a short time before delivery; in such a case the child generally comes into the world healthy, and it is our duty to protect it from contracting the disease through the milk.

No general rule can be laid down for our guidance in acute diseases. If there is reason to hope that suckling will not tax the woman too heavily, and that the child will not suffer with its mother, if there is reason to expect that the mother after the termination of her illness may be able to continue to nurse, the attempt to suckle may be made, but it must be abandoned as soon as any prejudicial effects show themselves. Many acute diseases from the very first prohibit a woman from beginning or continuing to suckle.

§ 235. The child should not be *applied to the breast* for 6 or 8 hours after birth, *i.e.* until the newly-delivered woman has had time to recover, has slept and rested for some hours; the child will then willingly take the breast. It is as a rule injurious to the development of lactation to wait longer, for instance 24—36 hours, as is still very customary from a belief that during the first two days the babe cannot get much from the breast, and that the mother is too exhausted to nurse. Under such circumstances the new-born child, badly or not at all nourished, speedily begins to waste, becomes somnolent and feeble, and consequently does not grasp the nipple as firmly and securely as it should, nor does it suck with the necessary vigour. The breast is insufficiently emptied, becomes over-distended and tender; the swelling of the gland causes apparent shortening of the nipple, and the sucking child in grasping it is obliged to press its nose more firmly against the breast; in so doing it blocks up its nostrils, and since while suckling it breathes through its nose, it is compelled to leave go the nipple. The incessant grasping and letting go the nipple which is produced by the above condition, the incomplete emptying of the breast, and the increasing difficulty in sucking which the child experiences, frequently lead to soreness of the nipple (through softening and abrasion of its epithelium), as well as to mastitis, and only too often all further attempts are discontinued. Lastly, it should be remembered that early suckling is the best means of bringing on and maintaining the secretion, and (through the emptying of the gland) of preventing painful swellings, and that the colostrum favours the action of the bowels in the new-born babe, and the discharge of the meconium at the proper time. These considerations must convince every one that it is best at an early period to apply the child to the breast.

At the first attempts it is well to instruct the lying-in woman, and to direct her only to give the baby her breast while she is in the sitting posture, and to press down the areola with two fingers placed one above, one below the nipple (so as to leave the nasal orifices of the child free); she should hold the child in a horizontal position, on the arm corresponding to the breast. For the first two days, she may give her breast as often as she pleases, but *the suckling child must very soon be accustomed to a regular routine.* While its stomach is not adapted to take in large quantities of nourishment, but is inclined to regurgitate, the breast should be given at least every two hours, later on every three hours, according to the development of the suckling babe; it should not get the breast at all during the night for about six hours (from 10 o'cl. in the evening till towards morning). The child soon gets accustomed to regular hours, and, instead of being a trouble, the nursing becomes a pleasure to the mother, who obtains the necessary time to recover, and has no excuse for taking the child into bed with her, a practice which must be strictly forbidden. The breasts are to be used alternately, and after nursing, the nipple should be well washed with pure fresh water, and thoroughly dried; it should also be bathed before the child is applied. When the child has drunk, its mouth should be carefully cleansed with a soft moistened linen napkin. This prevents the nipple from becoming sore, and fungi from growing in the mouth of the child; for the same reason the child should not be allowed to sleep with the nipple in its mouth. The more regularly the nursing takes place, the more uniformly both breasts are used, the smoother will be the whole process of lactation.

The *diet* must, as already mentioned, be strengthening and suited to the individual case. Occasionally even when the diet is bad, the milk may be copious and beneficial to the child, the mother being the only one to suffer; but as a rule with a bad diet the milk is scanty and poor, and the child does not thrive. According to the observations made by Decaisne during the siege of Paris (*Acad. d. Sciences*, 1872), when the amount of nourishment is insufficient, the total quantity of albuminate in milk remains the same, but the casein diminishes greatly, while the true albumin increases in the same proportion.

§ 236. The supply of milk may be *scanty* at first, but the woman need not at once give up suckling; she may still make a good nurse if she takes much liquid (especially beer), and lives on a highly animal diet; the so-called galactagogues are not much to be relied upon. The progress of the child should meanwhile be very carefully watched, so that if necessary another form of nourishment may be provided before it begins to waste. If on the other hand the milk is so *copious*, that the breasts are not entirely emptied by the babe, and become turgid, free action of the bowels should be promoted by laxatives; the breasts should be kept warmly covered and gently compressed against the thorax by a napkin, or they may be gently emptied at intervals by another child or by artificial means, *e.g.* a breast pump[1].

The *lactiferous ducts sometimes get plugged* by inspissated secretion, and by epithelium. The gland then becomes overfull, and the ineffectual irritation of the nipple may lead to inflammation, especially in the areola of the gland. This may at once be remedied, if every disturbance is carefully traced to its origin, if all dried particles are removed, and a thorough regular ablution is practised. The *nipple may be prevented from becoming inflamed or sore* (*e.g.* through erosion or excoriation or cracks on its surface, or at its base), as has already been mentioned more than once, by keeping it clean, and protecting it as far as possible, and when the epidermis is very tender, by the early regular use of india-rubber shields. If in spite of these precautions, inflammation or soreness occurs, it causes great pain and not rarely compels the woman to give up nursing entirely. If the nipple is simply inflamed, poultices should be applied followed by dilute lead lotion or strong (Russian) tea, when the inflammation subsides. *Excoriated and fissured nipples* should be kept constantly covered with rags dipped in tepid 5 per cent. carbolic water. This heals them very rapidly. Of course before every application of the child, the nipple and its areola must be carefully cleansed and washed[1]. This is the best plan that I know of, and does away with the necessity for a nipple shield; or the latter might be worn temporarily between the nursing periods, merely to prevent the nipple from being pressed and rubbed by the clothes. When the nipple is well again, it must still be taken care of for a while, and in such a case it is a good plan to continue the suckling for some time longer by means of an india-rubber shield. Sometimes however the nipple becomes so diseased, that it is best to remove the child for a short time; occasionally the woman is able to resume the nursing after an interval.

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[1] A good form of breast pump has been designed by Prof. Zweifel; it has an arrangement for enabling the mother to draw off her own milk (*Arch. f. Gyn.*, xiii., p. 463).

In the last place I must mention that the lying-in woman who is not nursing, should be kept on a much lower diet than one that is nursing. The bowels should be encouraged to act freely, the breasts should be kept warm, and gently compressed. The nursing mother should follow the same procedure, when her child is taken away; it matters not as far as the health of the mother is concerned, whether the latter is done gradually (as is usual) or suddenly, but gradual weaning is best for the child. It is very doubtful whether preparations of belladonna or iodide of potassium applied locally, have the power of arresting the lacteal secretion, as many believe; but in no case must anything be applied that irritates the breasts.

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[1] *Cf.* Haussmann, *Berliner Klin. Wochenschrift*, 1878, Nos. 14, 15.

b. Care of the New-born Child.

§ 237. The child, when separated from its mother, is put into a warm bath of 35° C. (95° F.) to be washed. If the vernix is tenacious and adherent, it must be softened and liquefied by rubbing in some kind of fat, but on no account must the skin be irritated by rough friction; great care is required in completely removing all the vernix from folds of skin.

The temperature of the bath must not be higher than that mentioned, since there can be but little doubt from published observations that trismus may be caused by too high a temperature (Keber); a thermometer should therefore be used to regulate the temperature of the water. Before or after having its bath, the child should be examined in reference to its conformation, and especially to the condition of the orifices of its body and the external genitals; it is then wrapped in a warm cloth, thoroughly dried and dressed.

The *remnant of the umbilical cord* should be wrapped in a piece of greased or oiled linen, turned up on the left side of the navel, and retained there by a broad bandage wound loosely round the body (umbilical bandage). The piece of linen covering the cord may be renewed, if it does not stick to the dried remnant; if it does, it should not be changed. When the dried piece of cord has fallen off, the still moist scar may be covered by a dry folded napkin or a pad of dry cotton wool which will come off in the bath after a few days. When the navel has healed, no special bandage is any longer necessary, but the broad umbilical binder may be retained as an abdominal bandage.

The clothing should be simple and easily changed. The child is to be kept warm, and its limbs allowed free movement; all swaddling is bad. A long white gown of soft linen, loosely tied round the neck, nowhere else, and open behind, should come next to the abdominal binder. Under the sacrum passes a broad triangular diaper, the sharp corner of which is drawn up between the legs, while the two ends of the broad side are loosely knotted over it. Into this napkin the child discharges fæces and urine, and it can at any time be easily renewed without changing the whole clothing. Above the linen gown should come a woollen dress, which opens behind and is long enough to be turned loosely up above the lower extremities; the whole is held together by a broad belt. The head may be left bare, or merely covered with a thin knitted cap. No pins should be used about the clothing.

§ 238. It is best for a child to lie, and not to be carried, except when necessary; the habit of carrying children spoils them, and later on leads to colds. The *bed* should have raised edges, but no thick curtains, and the babe should lie on a mattress or a smooth sack stuffed with chopped straw, its head being on a low pillow. Over the mattress is laid a linen sheet; the child itself is covered with a blanket or with a light feather bed. At the foot of the bed it is well always to have a hot water bottle wrapped in some napkins, which can be brought into requisition as soon as those on the child are wet. The latter may lie on its back or its side; it is a good plan to vary this sometimes. Cradles are undesirable, not because the rocking does much harm to children, but because it spoils them so that soon they will not be quiet without it.

Cleanliness of body and purity of air are of cardinal importance, if the child is to thrive; the latter must be bathed once or twice a day, its head also should be washed every day. Whenever the child has been soiled by excretions, as is generally announced by screams, it must be washed and dried. This is the best way of preventing the parts round the anus and external genitals, and the inguinal regions from becoming sore. If the child gets sore, linen rags dipped in cold lotio plumbi form the best application in a mild case; when severer, especially where there is a weeping intertrigo, applications of very dilute solutions of corrosive sublimate (·5—1000) must be applied three or four times a day. When the weeping ceases, the parts should be dressed with diachylon ointment mixed with a little olive oil.

If the child is in good health, it may during the warm season of the year be taken out of doors at the end of three weeks; but during the winter it is best in-doors. I need scarcely point out again what a great blessing it is both for the mother and her home, if a fixed routine in suckling the child is adopted from the very first.

§ 239. If the child cannot be suckled by its mother, it is necessary *either to procure a wet-nurse, or to feed it artificially*. The former method is always the best. Much has been said against the system of wet-nursing, and there are many inocueniences connected with it, but a wet-nurse is undoubtedly the est thing for the child, even if success is only attained after epeated attempts.

The *selection of a wet-nurse* is a matter in which the medical an can never guarantee success with absolute certainty. The rst requirement is that the wet-nurse shall be healthy, the econd that she have good breasts, and produce abundant and ood milk. She must be very carefully examined in reference to he state of her health; external appearances, one or two quesions and a superficial inspection of the genitals are not sufficient. Evidence of syphilis is especially to be looked for, but scrophuosis and chronic eruptions are also disqualifications. Her age hould be between 20 and 35 years; moreover it is desirable hat the wet-nurse shall know her business, *i.e.* that she have lready been confined two or three times, or, if she be a primiara, that her labour have not taken place quite recently, and hat she have already suckled her own child; if possible, 14 days hould have elapsed since her delivery. It is not necessary that he date of her confinement should coincide with the birth of the uckling for which she is intended, although on the other hand t is desirable that the interval be not too great. In an indiviual case it is better that the child of the nurse be older than hat which she is to suckle, than *vice versa*.

The breasts must be full, but not too fat; the nipples easy o grasp, not too readily hurt; it is not the very voluminous ammæ that give the most and best nourishment. The shape s more important; breasts which have a conical form towards he nipple generally indicate the best nurses. Inflammatory ndurations and eruptions on the breast are of course disqualifiations.

The milk is serviceable, when it gives a constantly alkaline eaction, has a specific gravity of 1025—1035, when the milk lobules are well formed and distinct from each other, when hose of medium size preponderate, and lastly when the proporon of fat determined with the lacto-butyrometer (Marchand) mounts to 3 to 4 per cent[1]. Moreover the milk must be abunant and flow readily; its ready outflow is easily ascertained by queezing the breasts between thumb and forefinger, but the uantity which can be supplied is only to be discovered by repeated observations. The appearance of the nurse's own child gives us a further guarantee of her suitability; it must therefore always be carefully examined before the engagement is concluded.

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[1] *Cf.* Conrad, *Die Untersuchung der Frauenmilch* &c. Bern, 1880.

Lastly, all these means of assistance may deceive us, and the best proof of the suitability of the nurse is the thriving condition of the suckling, and next to that the quantity of urine it discharges, and the condition of its intestinal canal. If these are watched, a change in the nurse, if necessary, will always be in time, although of course such a change should not be made unless essential, since the reason for the child not becoming at once accustomed to the change, as well as its previous non-thriving condition, may lie in itself. In order that the nursing may go on as well as possible, it is absolutely necessary that the nurse shall, as far as can be arranged, continue to follow her previous mode of life, and especially that she keep to her accustomed diet, and do enough work to keep her digestion in good order.

§ 240. *If the child is to be fed artificially*, it is indispensable to its doing well that cleanliness and regularity be observed, that the condition of the child be most carefully watched, and that the medical directions be followed. If these requirements are satisfied, the child may be very well reared in the way about to be described, and grow up strong. Unhappily they are but too often not satisfactorily carried out, and hence the majority of the poor creatures brought up in this manner pine away.

Feeding by hand must be made as similar to the natural mode of feeding as possible. The child should have nothing but milk, no solid food; the temperature of the milk being nearly that of the blood (35°—36° C.=95°—97° F.). The child must take it by sucking at definite intervals and in proper quantities, and the chemical composition of the milk must be approximated to human milk as nearly as may be. Of the various kinds of animal milk which are at our disposal, those of the *she-ass*, *of the mare*[1], and *of the goat* in descending order, are the most similar to woman's milk, but unhappily they are so difficult to obtain that only *cow's milk* can come into general use.

Cow's milk is much richer in albuminates, fat and salts, but somewhat poorer in sugar than woman's milk, as is shown by the following figures:

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[1] *Cf.* Langgaard "Vergleichende Untersuchungen über Frauen-, Kuh- und Stutenmilch", Virchow's *Arch.*, 65, 1875, p. 1.

	Woman's milk contains: (*Cf.* § 222.)		Cow's milk contains (according to Gorup-Besanez):	
Water	88·9		85·7	
Casein	3·9	10·94	4·8	14·21
Albumin	—		·57	
Butter	2·6		4·3	
Sugar	4·3		4	
Salts	·14		·54	

The latter must therefore be considerably diluted and somewhat sweetened, in order to become similar to the former. But even then it only does so to a very limited extent; for the great difference lies in the casein having a different composition in the two milks, that of cow's milk being tougher, harder, and taking much longer to digest than the casein in woman's milk. Owing to this difference, cow's milk can never be a perfect substitute.

In spite of this objection however, it will always continue in general use, and the following points must therefore be attended to. The milk should, when possible, be obtained from the same cow, and from an animal which is fed on dry fodder; green food often gives the child colic and diarrhœa. The milk must be fresh, and if possible given while still warm from the cow. If this cannot be, as when the milk is only obtained once a day, it should be boiled directly after the milking, and mixed with a little bicarbonate of soda or lime water[1], so as to delay fermentation. The vessels in which it is preserved, must be kept perfectly clean, and should be tightly closed as soon as they have been filled from the cow.

Boiled water should be used for diluting the milk, or still better very thin barley water, or a very thin decoction of arrowroot (1 tea-spoonful to 4 cups of water; the West Indian Maranta-arrowroot is the best); during the first 3—4 weeks in the proportion of 1 part of milk to 2 of water, later on in equal proportions; after the 3rd or 4th month, the quantity of milk may be increased, and as a general rule from the 5th or 6th onwards it may be given undiluted. The dilution must depend mainly on the degree to which the casein is digested; so long as there are undigested remnants of it in the fæces, the food must be given in a less and less concentrated form, till all that is given appears digested. Some milk-sugar should be added to the mixture in about the proportion of 30 grm. to one litre (ca. ʒij of lactose to Oss of milk), and this is then warmed by placing the feeding bottle in warm water, till it no longer causes any unpleasant sensation when applied to the eye. Till the sixth month at least the food should be given in an elongated bottle with a mouth-piece of black india-rubber, and holding about a cupfull of liquid; the child must never drink directly out of a spoon or a vessel, since by doing so it fills its stomach too rapidly. The bottle and the mouth-piece must after every meal be carefully washed, the mouth-piece by being left for some time in fresh water; it should also be again cleansed immediately before the bottle is refilled, so as to prevent any particles of milk that may still cling to it from turning sour. If plugs made of fine bath sponge (a fresh piece being used each time) are covered with thin gauze and fastened into the neck of the bottle a very good imitation of the nipple is obtained, and the milk is prevented from flowing out too rapidly; but their use is somewhat troublesome from the frequent renewal that is necessary[1].

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[1] Klebs (*Prag. Med. Wochenschrift*, No. 22, 1878) states that pure fresh milk kept constantly at a temperature of 65° to 75° C. (150°—167° F.), remains unchanged for 2—3 days.

As regards the frequency of meals and the quantity to be given, a routine must be followed even more strictly than in ordinary suckling. During the first period there should be intervals of 2—3 hours, these being increased as the meal after a time becomes more abundant; no fresh meal is to be given till the last appears to be entirely digested. 8—10 meals are sufficient during the first weeks, later on 5, since there is to be a time of rest at night. At first a meal of 4, 6 or 8 table-spoonfuls is sufficient; larger quantities distend the stomach, and bring on vomiting; that organ increases gradually in size corresponding to the progress and appetite of the child.

If all these directions are followed, a favourable result may be looked upon as probable. As indications of it we have the thriving of the infant and its increase in weight, the latter being taken every week, or even more frequently, and closely watched. The addition of alkalies for the purpose of making the milk more digestible, or of tea to strengthen the intestines, are based on erroneous ideas and should be avoided.

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[1] Soltmann (*Jahrbuch f. Kinderheilk.*, xii., Part 4, 1878) has contrived a [illegible] bottle, which is very suitable for sick and delicate children.

§ 241. The child however does not always do well on cow's milk, nor is the latter always to be obtained of the desirable quality. In such a case various substitutes may be employed, and amongst them the following deserve notice:

First of all the *mixture of cream* recommended by Kehrer and especially by Biedert, consisting of ⅛ of a litre of sweet cream (containing according to Hoppe-Seyler 9·5 per cent. of fat, 3 per cent. of milk-sugar and 4 per cent. of casein), with ⅜ of a litre of boiled water and 15 grm. of milk-sugar (cream ℥i, water ℥iij, milk-sugar ʒi). This mixture contains 1 per cent. of casein, 2·4 per cent. of butter and 3·6 per cent. of milk-sugar, and according to Biedert is always tolerated, and offers suitable nourishment. The mixture must afterwards, *i.e.* at intervals of some weeks, be made more concentrated by increasing the proportion of milk, till the diet becomes a purely milk one; the fæces must throughout be watched, and if undigested casein appears in them, the baby must at once go back to the previous stage of dilution. Over-distention of the stomach is also to be very carefully avoided, and the young child should not have more than ⅛ litre (℥iv—v) every two hours. This mixture is very useful, when the digestive tract is irritable, even in cases in which mother's milk does not answer, and at the period of weaning.

Condensed milk, as now exported from Switzerland (Vevey), and from large dairies elsewhere (Kemptener condensed milk manufactory), presents many advantages as a general article of diet, owing to its uniform composition and to the ease with which it is prepared. According to Werner and Kofler (*cf. sub* Fleischmann), it contains 18·1—24·4 per cent. of water, 12—13·6 of fat, 14—18 of milk-sugar, 2·1—2·6 of salts, 24·2—28·1 of casein and albumin, 24—30 of cane sugar; before being used it must be greatly diluted, much more so than is advised in the accompanying directions. Apart from the poor composition of some samples due to unskilful packing, the condensed milk contains too much sugar, a point which is not unimportant for the child's digestion, owing to its conversion into lactic acid. It will not do as the *only* article of diet, both for that reason and because it needs to be too much diluted, if it is to be permanently tolerated. In spite of these disadvantages however it is to be recommended in towns, where unadulterated milk is not always procurable[1].

Liebig's soup has not come into general use, in spite of the high expectations it raised, because its preparation requires an accuracy which can scarcely be expected or demanded from nurses, and because the necessary addition of cow's milk is to a great extent open to the same objections as is the diet of cow's milk alone. Older children, from the third month onwards, tolerate the soup better than do new-born infants, and like it better. Several manufacturers have reduced Liebig's food to the form of an extract; a convenient one is Liebig's "Soup extract", and also Liebig's "Infant food" (*cf.* Bergmann in *Bayr. Aerztl. Intel.-Blatt*, 35, 1877). Löflund's "Food for infants" is also good, and must be dissolved in warm milk. All of these can only be recommended for older children.

Nestlé's "*Milk food for infants*" is a fine powder, by which the public is spared the trouble of preparing Liebig's food, the necessary changes having been already effected by the chemist; the nurse's share in the preparation is simple. Young children get one spoonful of meal to ten spoonfuls of water, older ones 1 to 8; in cases of diarrhœa the drink is concentrated, and *vice versa*. Observations as regards the suitability of this food are discordant, but it is recommended by good observers as one of the best substitutes. We must however again insist, as has been already pointed out, that any substitute containing much starch flour can only be advantageously given after the 10th week of life, since it is not till then that the salivary glands can satisfactorily convert starch into dextrin and grape-sugar.

Many hand-fed children do not possess the same healthy and blooming appearance during the first weeks, as those have that are nursed at the breast; this fact alone however should not cause undue alarm; if necessary cow's milk may be alternated with other substitutes, or *vice versa*. It must not be forgotten that many children do not thrive even with the best of wet-nurses, that they may do better on a different diet, and that when the first difficulties have once been overcome, hand-fed children may grow strong; and further that to some extent they make up for all the trouble they have given, by escaping the difficulties to which sucklings are exposed during the period of weaning. But if the necessary care and attention are not given, and if the correct principles of feeding are not followed, the hand-fed child will never cease to ail and suffer, till the breast of a wet-nurse is again provided.

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[1] Fleischmann states that children fed exclusively on condensed milk often become rickety, although at the same time more or less fat.

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PART III.

PATHOLOGY AND THERAPEUTICS OF PREGNANCY, PARTURITION AND THE PUERPERAL STATE.

§ 242. To enable my reader to understand the following description, I must begin by defining the various kinds of mechanical interference that are peculiar to midwifery, *i.e.* the *obstetrical operations*. But I cannot here describe them fully, since a detailed account both of the indications for their use and of their mode of employment presupposes a full knowledge of the conditions under which they are practised, and the latter forms the subject of this part of my work. A superficial acquaintance with the objects of obstetrical operations will suffice for the present.

Apart from a few operations intended only for special cases, obstetrical operations have the object either of causing or facilitating the expulsion of the fœtus from the parturient canal (preparatory operations), or of supplementing the expulsive forces where they are insufficient (extraction operations). To the former class belong 1, the *induction of premature labour*, by which labour is brought on before pregnancy has reached its natural termination, but at a time at which the fœtus is viable; 2, the *induction of abortion*, by which labour is brought on before the fœtus is viable; 3, the *artificial rupture of the bag of membranes;* 4, *version, i.e.* the conversion of one fœtal "lie" into another, always into one of the forms of longitudinal lie. For assisting or supplementing the expulsive forces, we have the following means at our disposal: 1, *expression of the fœtus from without;* 2, *extraction beginning with the pelvic extremity*, whether this presented primarily, or was only brought down by version; 3, the *extraction of the head* by means of the *forceps*, an instrument (comparable to prolonged hands) consisting of two blades which are introduced separately, and afterwards easily united. In some cases it is necessary before the extraction to inish the resistance and size of the skull by opening and tying it (*perforation*), or to draw it out with crushing instru- its (*cephalothrypsy*), or with strong bone forceps (*cranioclasm*). ay also be necessary to open the cavities of the trunk, to break the vertebral column, or to remove certain portions of the y (*embryotomy*). Again, where the obstacles to delivery are great that the latter class of operations is inadmissible, or re they are not so consistent with the life of the child, an for the latter must be found through the uterine and ominal parietes (*Cæsarian section*). Finally, where the life he mother is in great peril, the spontaneous dilatation of the us cannot be waited for, but must be effected by force, and organ is then immediately emptied; this is *forced delivery* he narrower sense of the word (*Accouchement forcé*).

I.—The Pathology of Pregnancy.

§ 243. The diseases of pregnant women are either exacerbations of the usual deviations from a perfectly healthy condition, which thus transgress the limits of health; or incidental diseases not directly due to pregnancy, but whose progress is specially modified by it; or affections of the sexual organs; or finally anomalies in the development of the fœtus. The last chapter deals with uterine hæmorrhage in its various forms, and with the premature interruption of pregnancy. Some of these maladies persist during labour, and several of them will therefore for the sake of completeness only be described in the subsequent part.

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1. *Disorders caused by a Morbid Intensity of Physiological Phenomena.*

§ 244. The changes which take place in the system of a pregnant woman, have been described in § 76 *et seq.*, and we attempted to refer them to their causes. It is extremely difficult to draw the line at which these phenomena become morbid, especially as they generally only become so owing to individual peculiarities. The practitioner will require all his acumen in drawing the line, as well as tact in deciding how long he may maintain a passive attitude, and when he should interfere. The management of such a case invariably requires great care, since the conditions we are about to discuss may severely injure the system, and may terminate the pregnancy prematurely; and conversely such a premature termination is liable to be favoured by his mode of procedure. Moreover when the question of active interference comes up for discussion, it is well to remember that our therapeutical resources as a rule cannot cure the mischief; an alleviating treatment is generally the only one left, and is at the same time of most value. Above all the strength of the sick woman must be kept up as long as possible, and broadly speaking dietetic means will be of more service than medicinal.

The most important diseases are the following:

a. Changes in the Blood.

§ 245. The deterioration of blood which occurs in so many pregnant women, may become a true *hydræmia* (serous plethora, § 76). This differs but little in its outward signs from other kinds of dropsy, and can only be looked upon as an affection *sui generis*, where there is no disease either of the organs of circulation or of the kidneys. An individual predisposition will almost always be found, but bad nourishment during pregnancy and a damaged condition of the walls of the vessels constitute one of the main causes. Hydræmia leads to serous exudations into the subcutaneous areolar tissue, and into the great cavities of the body, especially that of the abdomen; its onset is sometimes slow, sometimes rapid, and occasionally the exudation disappears from one part in order suddenly to develop in another. Effusion into the thorax is specially dangerous when it forms unexpectedly and quickly. Amongst the subcutaneous exudations, those affecting the lower limbs and the external genitals are most troublesome, and since the pressure exerted by the uterus &c. in the pelvis is at the same time interfering with the return of the blood, they may reach an enormous extent. The face as a rule remains unaffected. The urine secreted is generally very abundant and dilute; when the kidneys are healthy, there is no albumin or only a temporary trace. The hydræmia rarely disappears before the termination of pregnancy, but the conditions it gives rise to may lead to premature labour; the previous good health rapidly returns, when the labour is over.

Treatment must aim at improving the composition of the blood, at inducing a copious excretion of water, and at alleviating the local discomfort. In regard to the first point the indications are clear, and to be regulated mainly according to individual conditions. There is nothing better than a prolonged course of iron; and I can strongly recommend for these cases the combination of iron with phosphate of lime (aa ·2 grm. = gr. iij, ter die), or with alkalies (especially Blaud's pills[1]), which at the same time have a diuretic action. Irritating diuretics and the frequent use of saline purgatives are to be avoided. The œdema of the lower extremities is best combated by keeping them raised, by alcoholic liniments, by bandages and elastic stockings; that of the labia by aromatic lotions, chamomile hip-baths and purgatives. Punctures should not be made rashly; they often bring on "pains", and the punctured points are apt to become inflamed.

§ 246. In very rare cases the impoverishment of blood does not lead to hydræmia, but to *anæmia* of the severest type. This was long ago described by Addison and Lebert, and called *progressive pernicious anæmia* by Biermer; but Gusserow was the first to show that it occurred in pregnant women. Its nature is that of a true oligæmia or better oligocythosis, to which hydræmia is afterwards superadded. The ætiology is still obscure. We may however take it for granted that the blood-forming apparatus is diseased in such a way that too few red corpuscles are formed, and that too many atrophied ones, *i.e.* corpuscles whose form has not attained full development, are continually thrown out into the circulation; with this disturbance in the formation of red corpuscles, an active disintegration of those already present gradually becomes associated. At any rate the hydræmia of pregnancy offers a favourable soil for the development of pernicious anæmia, although the latter does not originate spontaneously from the former during pregnancy, unless specially favourable conditions are present in the organism, *e.g.* hypoplasia of the vascular system (essential chlorosis), and when in women who are subject to hypoplasia pregnancies follow rapidly upon each other, and assisted by the periods of lactation bring the income and expenditure of the body into great disproportion. Fatty degeneration of the cardiac muscle (especially of the papillary muscles) is almost always present; also of the intima of the arteries and of the capillaries in some places. These changes as well as the almost constant retinal hæmorrhages are certainly secondary.

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[1] Their composition is given in Johnson's "Medical Formulary."

Ferri sulph. partes 30, Pot. Carb. 30, gum. acaciæ 5, aquæ 30, syrupi simplicis 15. Dissolve the gum in the water, on a water bath; add the syrup and iron, then the carbonate of potassium and evaporate to proper consistence; divide into pills of ·4 grm. (gr. vj) each. Dose, 1—3 pills ter die (Tr.).

The disease generally begins insidiously (as is indicated by the term progressive anæmia) during the earlier months of pregnancy, although the first threatening symptoms as a rule only show themselves during the second half, and is extremely dangerous. Out of 25 cases collected by Graefe (*l. c.*), almost all died, most of them very rapidly, soon after labour; the majority had died before 10 months after the distinct appearance of the disease; only one is spoken of as cured, but two were discharged as improved. The pregnancy often terminates prematurely (out of those 25 cases it did so 12 times, once in the sixth, 5 times in the seventh, 4 times in the eighth and once in the ninth month; of one case there is no record). The induction of premature labour or of abortion is urgently called for, and indeed before the disease attains its maximum severity, since when it has done so, the very act of parturition, even though the accompanying loss of blood be but very small, may suffice rapidly to cause death. The three cases mentioned above show that when pregnancy is terminated, *i.e.* when the chief cause is removed, the disease may be arrested and the dangerous symptoms checked; but the probability of this happening will be greater, the earlier the pregnancy is brought to an end. Transfusion also must be looked upon as a rational proceeding, although the four cases in which it was carried out (*cf.* Graefe) ended fatally in spite of it; perhaps the operation was done too late, perhaps also the want of success was due to the way in which it was performed. Further observations must decide upon its value. Dietetic and medicinal means are only of use at the beginning of the disease.

A treatment similar (from an obstetrical point of view) to that of the disease which has just been described, is required by the *hæmorrhagic diathesis* which is occasionally met with, and in the development of which pregnancy seems sometimes to take an important share. (*Cf.* Kehrer, "Die Hämophilie beim weiblichen Geschlechte," *Arch. f. Gyn.*, x., p. 201.)

§ 247. I believe that my investigations (*cf.* § 76) have established on theoretical grounds the occurrence of a *true plethora* with pathological sequelæ, the existence of which had for clinical reasons seemed probable. A considerable increase in the total quantity of blood will of course only show itself under very favourable conditions, and during the second half of pregnancy.

The symptoms are for the most part local: congestion of the chest and head, palpitations, tendency to vertigo, engorgement of the portal system, sluggish action of the bowels; these symptoms may be peculiarly troublesome during the exertion of labour. Plenty of muscular activity, a sparing diet, and an abundant consumption of water, now and again a saline purgative, are the remedies to be recommended. Moreover the experience of many a country practitioner shows how beneficially small, and even repeated, venesections act on the disorders that have been mentioned; to forbid them altogether in pregnant women is an even more one-sided practice, than was the former routine of bleeding for every ailment that accompanied pregnancy.

b. Disorders connected with the Circulation.

§ 248. Œdema and varices of the lower extremities and of the pelvis are the only circulatory disorders, which, when the system is healthy, can assume grave characters during pregnancy and need to be mentioned (*cf.* § 74).

This *mechanical œdema* may be distinguished from that due to hydræmia, by being restricted to the regions just mentioned, by as a rule only becoming marked during the last months, by never reaching such a degree of severity, and by diminishing with the horizontal position. The advice to be given under such circumstances is obvious.

Varicose veins are most common in multiparæ, although by no means rare in primiparæ. They may be capillary, in which case an arborescent net-work of bluish vessels is seen round the ankles, and especially on the inner surface of the thighs. This variety has no importance, unless the great veins too are involved. The saphena seems to be the first to undergo dilatation, then its lateral branches, which form great swellings on the inner surface of the leg and thigh, especially above the knee. It is clear however from the great frequency with which the hæmorrhoidal and vulvar veins are affected, that the deep vessels lying below the point of bifurcation of the iliac veins are also involved. Both limbs usually suffer; when only one is affected, the left is so most frequently.

As a rule varices only become severe during the second half of pregnancy. Generally they merely form an unpleasant complication, but they may grow dangerous by inflammation and suppuration, by thrombosis and even by embolism, lastly and chiefly by rupture. I know of *four cases in which death resulted from hæmorrhage*[1] due to such a cause. The treatment of varices is that of œdema of the lower extremities, and in such cases a proper dietetic *régime*, attention to easy defæcation, and symmetrical compression of the thighs are especially important; injections of ergotine (grm. ·1=gr. iss, to be repeated) into the affected limb are always worthy of trial, nor is there any risk that the progress of pregnancy will be disturbed by them. Inflammation, suppuration, and rupture must be treated according to the usual principles; rupture by a firm compress followed by a suture.

c. *Disorders of Digestion.*

§ 249. The severest of these is the so-called *uncontrollable vomiting*. Retching and vomiting, when the stomach is empty or soon after food, are unimportant symptoms during the first months of pregnancy, and do not seriously alarm the pregnant woman or her friends; but the persistent vomiting in which the stomach retains absolutely nothing is, if at all prolonged, a very grave symptom. The patient rapidly grows thin, the efforts at vomiting (which may set in without any food being taken) soon bring up nothing but thin clear or greenish coloured mucus, which is not infrequently streaked with blood. The mouth grows dry, the tongue fiery red and glistening, the breath offensive, the skin dry and pale. The urine is very scanty and concentrated; constipation is almost always present; thirst is great and very distressing, owing to the refusal of the stomach to take anything. Fever also is present. It is remarkable how long the onset of extreme marasmus may be delayed, even when assimilation is arrested; but eventually it shows itself, and the woman dies from exhaustion, or falls a victim to some intercurrent, under other circumstances perhaps slight, illness.

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[1] Once from a varix of the leg in a laundress (vii-p.) who was in the eighth month of pregnancy, and fell down dead at the entrance to the lying-in establishment where she sought assistance; once in a woman (vi-p.) in the ninth month from a varix on the inner surface of the right labium; twice in primiparæ, in one woman at the 24th week, the varix being on the posterior side of the right thigh; the other was near the normal end of her pregnancy, the hæmorrhage occurring from the inner side of the left leg.

In a few cases pulmonary phthisis has been the means of death. It might be supposed that the efforts at vomiting and retching would generally lead to abortion, but this is not the case; if the labour comes on spontaneously, it generally does so but a short time before death, and the accompanying loss of blood and the exertion of labour merely accelerate the end. In some cases however abortion takes place before the condition of the pregnant woman has become hopeless, and she then usually improves. Now and again the disease is suddenly arrested, especially about the time when the uterus increases in size more rapidly than usual, *i.e.* when pregnancy has considerably advanced; occasionally also when the first fœtal movements are felt.

The important fact has occasionally been observed that on the death of the fœtus, the vomiting has suddenly entirely ceased and convalescence set in. Thus also is to be explained the fact that in cases where abortion takes place spontaneously or artificially a short time before the end, or at the time when the sickness is most severe, the fœtus is almost always quite fresh, while in those cases where abortion occurs at the time of, or after the subsidence of, the illness, it is not uncommonly found already macerated.

Primiparæ are more often attacked by this serious disorder than women who have already borne children. It comes on between the second and the sixth month, the first and the last ones appearing to enjoy an immunity; it is commonest in the interval between the beginning of the second and the end of the fourth month. Now and then some serious disease of the stomach (simple ulcers, or infiltrations of the gastric walls) gives rise to the vomiting, but as a rule the *causes* are obscure; of course such a cause should always be looked for in the first instance, and its detection may be exceedingly difficult. Where such a cause can be excluded, we must seek for an explanation in the well known "sympathy" between the genital organs and the stomach, in perverted innervation, and with reference to this point it is important to note that in quite a large number of cases some source of irritation has been found in the uterus, *e.g.* flexion with impaction in the pelvis, or some hindrance to its rising up out of the latter, or an inflammatory swelling at a circumscribed portion of the body and especially of the cervix, with or without ulceration. Nevertheless there are numerous cases in which no objective organic change can be detected.

An accurate diagnosis is therefore of the greatest importance for the *management* of these cases. If one of the conditions mentioned above is found, this is first of all to be treated; and in such an instance abstraction of blood from, or cauterisation of, the cervix may be of the greatest value. If no such a cause is found, we can only treat the symptoms, to which indeed we are restricted in those cases also in which local treatment has failed. The remedies recommended are so numerous and so various, that we can from this fact alone conclude that they are almost invariably useless, as far as a permanent cure is concerned. First and foremost we find the most diverse sedatives and narcotics, administered by the stomach, by the rectum, by inhalations, or subcutaneously; cutaneous irritants also are applied to the region of the stomach. Ice is given internally, or kept on the epigastrium several times a day from half to one hour at a time, and may be very beneficial; the local application may be followed up by stimulating fomentations (mustard and camphor). The frequently repeated use of ether spray on the gastric region is also eulogised. Amongst internal remedies, the *oxalate of cerium* is highly spoken of; ·2—·3 grm. = 3—4½ grs. being given several times daily (Peters, *New York Medical Record*, March 3, 1877; Conrad, *Schweiz. Correspondenz Blatt*, No. 23, 1878); also *bromide of potassium* in doses of 1 grm. (15 grs.) several times a day (Friedreich), or *per rectum* according to American authors; *tannin* also in ·2 grm. = 3 grs. doses (Duboué, *Arch. Tocol.*, Sept., 1877); the *tinct. nuc. vomic.* is recommended by Roth (*Centr.-Bl. f. Gyn.*, 1877, No. 18) in doses of 15 to 20 drops four times a day. The horizontal dorsal decubitus is of high value here, as in the vomiting of sea sickness. The greatest attention must be paid to the regular action of the bowels, and as a rule they are very troublesome; small doses of calomel, and Carlsbad salts are recommended for this purpose. If the patient can sleep fairly well, *i.e.* for some hours uninterruptedly, she should always have something to eat before going to sleep. In a very severe case I kept my patient alive by allowing her to have every quarter of an hour for more than fourteen days just one table-spoonful of liquid easily digestible food: meat broths, iced milk, tea with milk, water, given alternately. The stomach did not reject these small quantities; and if regurgitation did occur, they were again swallowed, the patient being thus kept up till the vomiting gradually subsided. Before extreme measures are resorted to, nourishment is to be supplied by means of pancreatised meat enemata (Leube). Copeman (*Brit. Med. Journal*, May 15, 1875, and Sept. 28, 1878) recommends as an excellent, *i.e.* unfailing, remedy the dilatation of the external os uteri and of a portion of the cervical canal; further published observations support this recommendation (Murillo, *Annal. Gynéc.*, p. 233; Rosenthal, *Berlin. Kl. Wochenschrift*, 1879, p. 388).

Our last resort is to *empty the uterus, i.e.* to induce abortion; premature labour will but rarely have to be considered, owing to the period of pregnancy at which the disorder under discussion generally attains its maximum severity. Abortion is justified by the fact that the persistent vomiting may be fatal, that on the other hand it frequently ceases after a spontaneous evacuation of the uterus, and lastly that numerous instances have been published in which artificial abortion was the means of cure (this result occurred in 27 out of 36 carefully observed cases which were collected by M'Clintock). On the other hand it must not be forgotten that in some cases which were looked upon as utterly hopeless, the vomiting subsided spontaneously, both mother and fœtus being preserved; that in other cases even the operation did not succeed in saving the life of the former; and that sometimes when the operation was not successful, the vomiting ceased after a while. Each individual case therefore must be judged on its own merits; the only general rule that can be laid down is that no interference is justifiable till a sufficient trial has been made of all those measures which are consistent with the progress of the pregnancy (and here I will once again call attention to Copeman's recommendation, and to the value of nutrient enemata for preventing extreme marasmus). Such interference however must not be postponed till it is too late, *e.g.* till a fatal termination is obviously unavoidable; and sometimes the disease advances suddenly and rapidly to this lamentable termination. The responsibility of the operation must never be undertaken by a practitioner, except after a consultation with a colleague experienced in the management of such maladies.

§ 250. The *salivation* which has been already mentioned may not only be troublesome, but when excessive may greatly weaken pregnant woman. Astringent lotions for the mouth may be d, but are generally useless. Iron and a good diet are of st value; also iodide of potassium, as far as it can safely be en during pregnancy. Ebstein (*Berliner Kl. Wochenschrift*, 25, 1873) recommends atropine, a drug which is known to lish the action of the chorda tympani on the salivary secre-; ·0006—·0015 grm. (=·01—·025 gr.) may be injected cutaneously in the vicinity of the submaxillary gland.

onstipation rarely becomes so obstinate as to cause anxiety, *diarrhœa* may do so, and I would draw attention to this rder, although it is not directly due to the pregnancy. Apart its weakening action, it may, if at all prolonged, lead to nature labour, especially when dependent upon catarrh of the t intestine and accompanied by severe tenesmus. It should r be thought lightly of.

d. Disorders connected with the Urinary System.

251. Severe disorders connected with the excretion of urine ither one or other direction, either depend upon anomalies of uterus and its neighbouring organs, or are independent bles; as far as pregnancy is a factor in their causation, it be sufficient to refer to what has been said in § 74.

mongst the changes in the composition of urine, *albuminuria* e needs mention here. It is desirable in each case to elute its cause, owing to its important bearing on prognosis Eclampsia); and in reference to this point it must be noticed it may not only be due to changes in the renal parenchyma, o altered relations as regards the processes of diffusion in the neys, but may also be due to a formation of pus in any portion he urinary passages. It is therefore found in cases of able bladder or catarrh of that organ or of the urethra, which have been in existence before pregnancy, or it may originate ing the latter from (in addition to other causes) pressure on neck of the bladder and the upper portion of the urethra, or pyelitis. Treatment varies with the nature of the albuuria, and for this matter I must refer to text books of ology.

the albuminuria resists all rational modes of treatment, if sequelæ threaten life, it may be necessary to bring the pregnancy to an end. But such an albuminuria is always consequence of *nephritis*, which either sets in in the acu parenchymatous form, or was present as a chronic nephri before the pregnancy began, and becomes intensified during t latter by the frequently associated engorgement of the kidneys

e. Diseases of the Skin.

§ 252. Diseases of the skin are exceedingly common in pregnancy, and some ætiological connection must therefore exist (*cf.* § 80). This is also shown by the fact that the several kinds often only disappear with the post-partum period; latent diatheses seem sometimes not to be called into life, till pregnancy sets in. All forms of cutaneous diseases are met with, but especially *anomalous pigmentations*, *affections of the follicles*, *new vascular formations* and *neuroses* (*pruritus*). The latter are rare, but may be very obstinate and severe, and cause great suffering. I have had under my care an elderly lady, a primipara, in whom the affection began as early as the second month, and lasted till her confinement, with only a slight remission accompanying the use of Fowler's solution. Delivery and the free perspirations associated with the pains, at once led to its disappearance. No eruption was present except that caused by the frightful scratching. The woman became so reduced, that at the 5th month artificial abortion was seriously meditated; but I did not induce it because the digestive organs were in good order, and the woman was most anxious for a child. The latter was born perhaps 2—3 weeks too early, but was healthy and together with its mother (who has not become pregnant again) did well. *Pruritus of the external genitals* is commoner than the general affection; happily many of the cases that are so-called, are merely symptomatic, and due to a local inflammation and eczema. Treatment is not altered by the existence of pregnancy. I have found the most reliable to be the use of solutions of corrosive sublimate applied 1—3 times (1 : 100—200 parts of dilute alcohol), followed by the application of tar water (aqua picis liquidæ), and by chamomile hip-baths.

A very peculiar affection is described by Hebra as *impetigo herpetiformis*, which he has seen 5 times. In every case small pustules appeared on the inner side of the thighs, accompanied by high fever and great prostration; these pustules rapidly spread up the body till they reached the hairy scalp; the groups that appeared first dried up in the middle, and at the same time extended peripherally, like herpes iris. In four cases the disease ended fatally, but the post-mortem threw no light on its causation; in the fifth, convalescence took place after several relapses. Bulkley describes a similar, though different and much less dangerous, affection, as *herpes gestationis*; this also begins with clusters of vesicles on the extremities, and from there passes to the trunk. At first it is accompanied by pruritus and urticaria; it appears early in the course of pregnancy, only disappears in the post-partum period, and frequently recurs with a fresh conception. The treatment differs in no respect from that of similar affections in the non-gravid condition.

f. Neuroses.

§ 253. The highly impressionable condition of the nervous system may, as already mentioned in § 81, lead to disorder in any of its departments; but as a rule serious illness only arises, when a special predisposition exists. Amongst the neuroses, *eclampsia* undoubtedly takes the chief place; it will be dealt with in the part devoted to the "Pathology of Labour"; the *psychical disorders* will be described under the "Pathology of the Puerperal State"; both these troubles may occur during any part of the pregnancy or the puerperal state, but it will be most convenient to complete the description in one place. *Chorea* on the other hand requires some mention here; for although it is often merely a disease complicating pregnancy, yet cases are met with, in which we must consider that some direct ætiological connection exists, *i.e.* that the chorea is due to changes affecting the system in connection with pregnancy.

Chorea is not common. I have only seen it three times in a by no means small range of practice; Barnes could only find 56 published cases, which Fehling increased to 68[1]. In a large number of them the chorea existed before pregnancy set in; in the majority it appeared in the first half of the latter, and lasted to the beginning and even to the end of labour. It rarely terminated before parturition began; still more rarely (in 3 out of 84 cases) did it persist beyond the lying-in state. It is almost always bilateral. Primiparæ appear more susceptible than multiparæ, a fact which depends on the predisposition to illness which is so often already present, and on the greater frequency with which causative influences operate during a first pregnancy. An attack during the latter however need not make us fear a recurrence in the following ones. It is extremely rare for the chorea to begin during the lying-in period.

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[1] In Schwechten's (*l. c.*) dissertation, 80 cases are described; there is one more by myself, one by Prince, and two by Richardson, making 84 cases; the following statistics are based on this series.

If we except the cases in which serious lesions of the nervous centres can be demonstrated, or in which hereditary disposition exists, the *causes* of chorea are obscure, just as they are in the disease apart from pregnancy. The association with rheumatism and cardiac mischief has been sometimes observed, and it is possible that some of the cerebral changes that have been referred to, are connected with embolic processes originating in the heart. In a few cases albumin and sugar were present in the urine, bu only temporarily; an increase in the urates and phosphates i more frequent, due possibly to the great nervous activity and the muscular work. But in a great number of observations, clearly defined cause could be found, and such cases must regarded as reflex neuroses, which where there is a predisposi develop under the influence of insufficient nourishment o centres (due to the impoverished state of the blood) a the peripheral irritation in the generative organs; for a nourished condition, a slight bodily development (im development of the vascular system) and anæmia are c not rare in choreic patients.

The disease ended fatally in 23 out of 84 cases, almos in consequence of pre-existing or secondary compl When these are absent, the prognosis as regards life much as in the chorea of puberty. On the other hand it i for chorea to pass into other diseases of the brain. Its on the progress of pregnancy is not favourable; in sca the cases referred to was the natural termination re this respect chorea resembles eclampsia, but the ir death does not always precede the premature labo fœtus is often born alive. I must not forget to n new-born children are said to have been seen suffer ame disease. Chorea is much less serious during the lying-in tate.

The remedies generally recommended for chorea are hardly ver of use during pregnancy; broadly speaking therefore pecifics may be left on one side. On the other hand a non-rritating *régime* is very desirable, together with the use of iron nd quinine (the former especially in moderately large doses). arcotics are of the greatest value for cutting short and diminishng the severity of the attacks, as well as for quieting the great eflex irritability; opium in large doses; bromide of potassium iven for a length of time; chloral, chloroform and morphia subcutaneously), when an immediate effect is required. Bearing n mind the possibility of severe central affections developing, hen the chorea lasts till the expulsion of the fœtus, and bearing n mind also that such expulsion so frequently comes on premaurely, the induction of premature labour and even of abortion re indicated, when palliatives prove useless and the prognosis bad; but operative interference must not be postponed till too te. In view of the great irritability of the patient, the gentlest ethods must be employed for the operation.

§ 254. That which has been said above about chorea, is still ruer of *epilepsy*. Where this is present, the complication lmost always existed before pregnancy; its attacks are someimes unaffected by the latter, sometimes diminished both in requency and intensity. In very rare cases however pregnancy ppears to give rise to the first outbreak of convulsions, although nly where the predisposition already existed. Under such ircumstances, parturition is unaffected, indeed its onset usually ounter-acts the predisposition. When pregnancy recurs, the isorder is apt to return. Epileptic convulsions have but rarely prejudicial influence on the fœtus. Instances are on record in hich the convulsions appeared to be determined by the sex of he fœtus (by the male sex, according to La Motte, v. Swieten).

§ 255. Amongst the severe disorders of the organs of sense, need only mention those connected with *vision*. Apart from he *amaurosis* which is at times associated with eclampsia and lbuminuria due to Bright's disease, the more serious forms of *mblyopia* and night blindness (*hemeralopia*) are the commonest, lthough even they are very rare. Colour blindness is very xceptional; no case of *nyctalopia* has as yet been recorded.

When these anomalies do not depend upon disordered nutrition of the retina, as is sometimes the case, they are due to a highly anæmic condition, or are mere associated anomalies of sensation, much like the association that is seen during the development of menstruation and even in diseases of the genital system. They should therefore not cause alarm, for after lasting for a while, or at any rate during the post-partum period, they will certainly disappear: no relapse takes place. Nor are the disorders connected with a disturbed condition of nutrition of the retina, as dangerous as might be supposed. Proper diet with the use of iron and quinine (in large doses) are the remedies to be recommended.

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2. *Complications due to Intercurrent Diseases.*

§ 256. There is no disease which is prevented by pregnancy from attacking a woman, and any disease that existed before conception for the most part runs its course unaffected by it. In former times it was generally believed that the puerperal condition was a protection against many diseases, and had a urative influence over others; but this is not the case. On he contrary, there are a number of intercurrent diseases whose rogress is modified by pregnancy, parturition, and the post-artum state, and generally speaking not in a favourable direc-ion; conversely, such diseases may have a disturbing influence n the course of pregnancy. It is only of these, and indeed of he most important of them that we shall here speak, viz. the cute infectious diseases, intermittent fever, icterus, diseases of he heart and lungs, tuberculosis and syphilis. The affections f the sexual organs will be left for the following chapter.

a. Acute Infectious Diseases.

§ 257. The acute infectious diseases mainly influence the rogress of pregnancy in two directions; on the one hand by ading directly to the death of the fœtus, and on the other and by giving rise to a hæmorrhagic endometritis. In both ases labour comes on prematurely, and the physical exertion onnected with it, and especially the loss of blood, very often ggravate the existing disease, and not rarely lead to a fatal sult.

Intra-uterine death is almost always due to a considerable se in the maternal temperature; only in rare cases can it be scribed to the fœtus becoming infected by the disease of the other; such infection can only be affirmed with confidence of ariola[1]. Since the fœtus has a somewhat higher temperature han the mother, even when healthy, this must also be true in ver. The fœtus shows it by more active movements, by a reater frequency of its heart-beat, which generally keeps pace ith the temperature of the mother, rather than with her pulse. ut sooner or later the movements and the cardiac activity are aralysed and the fœtus dies, a result undoubtedly and entirely wing to the excessive retention of heat with all its accompanying hanges in the most important organs. Thus we can understand how, as Kaminsky has shown, a maternal temperature of ver 40° C. (=104° F.) may be very dangerous to the fœtus. nd if a high temperature is less injurious in the non-infectious inflammatory diseases, this depends on the circumstance that lasts a less time in the latter, or at any rate remains at a high level for a shorter period than in infectious diseases.

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[1] Spitz in the hospital here has seen spirilla in the blood of the fœtus of a woman ith relapsing fever. The same observation has been made by Albrecht; *cf. Petersb. ed. Wochenschrift*, No. 18, 1880.

Apart from the excessive retention of heat, the fœtus may, as Runge has shown, perish through want of oxygen, and indeed in all cases in which the disease greatly lowers the blood-pressure of the mother. And in the last place it must not be forgotten that the epithelium of the fœtal placenta (so important for the life of the fœtus) may degenerate in consequence of the influence of the diseased maternal blood on the ovum, and directly lead to the death of the fœtus.

Inflammation of the inner wall of the uterus during infectious diseases is no rare occurrence; owing to the diseased state of the blood, it is frequently associated with hæmorrhage, and hence arises that uterine hæmorrhage which is so often spoken of as menstruation or pseudo-menstruation. The same thing doubtless often occurs in the pregnant uterus also; in the case of cholera it has been distinctly proved by Slavjansky. The continuance of pregnancy however is incompatible with the destruction by hæmorrhage of the decidua, if at all extensive. Nor must it be forgotten that disease of the fœtal membranes often follows on that of the decidua, and thus tends further to provoke the expulsion of the fœtus.

I was the first to show that diseased, and especially over-heated, blood might increase the irritability of the uterus, and directly stimulate the organ to contraction, and Runge has brought forward experimental evidence in favour of this view; in this way therefore the pregnancy may also be interrupted, and the fœtus born alive.

As regards particular diseases, the following points should be noted:

§ 258. The *acute exanthemata* attack pregnant women more often in the early than in the later months; but the liability to the severer forms of illness as well as the mortality, increase with the duration of pregnancy. *Variola* is the disease most frequently observed, and is a source of extreme danger owing to the susceptibility of the pregnant woman to the hæmorrhagic form. This is doubtless the chief reason why abortion and premature labour set in so frequently, and why the disposition to severe uterine hæmorrhage is so great. Nevertheless the fœtus may also perish primarily, in the manner already mentioned. It then comes into the world with or without the signs of variolous infection. *If it is born alive,* the exanthem may break out subsequently, and in such a case it generally does so when labour has taken place at an early period of the maternal illness; it is usual then for the eruption to show itself on the child 8 to 10 days after birth. If the disease runs its course without interrupting pregnancy, the new-born child may have suffered and recovered from the disease while still *in utero*, and be born covered with scars. I must however also mention that it may remain quite unaffected, both when the labour is premature, and when it occurs at the full term. Great interest attaches to the cases in which the fœtus is attacked with variola *in utero*, or immediately after birth, without its mother suffering from the disease[1], and also to the rare occurrence of only one of twin fœtuses taking small-pox.

During small-pox epidemics, abortions are not uncommonly accompanied by great hæmorrhage, without the exanthem breaking out either in mother or fœtus; and lastly, it has been observed that the vaccination of a child born in good health of a mother who has been recently attacked by variola, will only be successful, after a considerable period has elapsed.

Bearing in mind the danger of small-pox in the pregnant condition, it is always desirable whenever an epidemic breaks out, and throughout its continuance, strongly to urge all gravid women to be re-vaccinated; all the more as according to observations in the lower animals the permeation of the mother with the vaccine poison destroys the susceptibility of the fœtus for a subsequent inoculation, and this appears to be the case in man also (Bollinger, Burckhardt); thus we are able to perform what we may call an *intra-uterine vaccination*.

Scarlet fever and *measles* are rare during pregnancy, as indeed generally in adults. The former appears most frequently during the lying-in condition, though the disease has as a rule been contracted during pregnancy; sometimes however the scarlet fever breaks out during the latter. In severe cases it soon leads to expulsion of the fœtus (in at least 4 out of 7 cases), probably owing to the high febrile temperature; during labour this may rise extremely high, to above 42° C. (107·5° F.). *Measles* are mainly dangerous, owing to the frequency of the hæmorrhagic form, and to the complication with pneumonia.

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[1] Such cases are recorded by Sedgwick (*Medical Times*, 1871, i., p. 673), by Laurens and Chantreuil (*Arch. Tocolog.*, 1877, p. 760), and others.

The management of the exanthemata should be based on general therapeutical principles; the ordinary rules applicable to them are to be followed, in spite of the co-existence of pregnancy; but in these cases it is especially desirable, for the reason mentioned above, to watch for the decrease of the fever, and to make use of the cold water treatment.

§ 259. Of all epidemic diseases, *cholera* is the one which most frequently attacks pregnant women; it does so relatively as often as non-gravid women. Here also the statement that the disposition to disease as well as the mortality are greater during the second than during the first half of pregnancy holds good; the 6th and 7th months are especially bad. The disease may be fatal without labour coming on; it may also terminate in convalescence, without pregnancy being interrupted or the death of the fœtus having taken place; such results however are confined to the slighter attacks. It is extremely common for cholera to bring on labour, and most often of course premature labour. Not only has cholera therefore an unfavourable influence on pregnancy, but the latter is also unfavourable in its influence on the former: the mortality is higher than in the non-gravid condition. This mortality, as well as the severity of the illness, appear to be somewhat diminished during the lying-in period; it is only in exceptional cases that labour diminishes the duration of, or indeed cuts short, the illness. The onset of genuine puerperal diseases is not prevented by cholera, nor does the latter predispose to them. Moreover the symptoms and the post-mortem appearances (bearing in mind the puerperal condition of the genitals) do not differ from what is usually met with; mention has been made above of the endometritis hæmorrhagica which is almost always present.

This change in the uterus is the chief cause of labour coming on so frequently during the disease, and especially during its typhoid stage. But the fact that the fœtus so often dies while still in the uterus, and is not uncommonly born dead, even when labour occurs at the proper time, shows that the fœtus is directly imperilled by the disease; the fœtuses of pregnant women in a state of collapse almost invariably perish. Still we have at present no perfectly clear evidence that the disease may be transmitted to the intra-uterine fœtus, the mother being attacked or escaping altogether, as is the case in variola; probably the fœtus collapses and perishes owing to the loss of water by the mother, to the slowing of her circulation and to her collapse, as well as owing to a simultaneous operation of the changes in the fœtal placenta. The treatment of cholera is in no way affected by the co-existence of pregnancy; the proposal to induce premature labour, founded on an occasional observation that progress became more favourable after spontaneous labour, will probably scarcely bring about the desired result, since the invasion of the disease leaves no time for the result of the operation; possibly an acceleration by gentle means of a labour that had already begun, might be advisable. As the lacteal secretion of lying-in women suffering from cholera is never quite arrested, the woman may be allowed to continue to nurse, in cases where the milk is abundant and the disease is not very severe.

§ 260. The various forms of *continued fever* (typhus, enteric and relapsing fever) may attack a woman during any month of pregnancy; but they do with greater rarity, the further gestation has advanced. In the rare cases in which the invasion takes place soon after labour, infection must have occurred before delivery. Whether an attack coming on during the later months of pregnancy involves greater risk, as has been affirmed of *enteric fever*, is very doubtful; the abortion which so often takes place during the earlier periods, seems, owing to the hæmorrhage connected with it, to damage the prognosis more than does the labour which sets in at a later date, and during which the hæmorrhage generally lasts a much shorter period. But the danger attending the disease, depends above all on that stage of it at which the pregnancy is interrupted; the earlier in the disease labour takes place the better, probably because the organism has not yet been too greatly reduced. The tendency to abortion is greatest in enteric fever, even more so than in cholera; it is least in *typhus*. Statements differ in regard to *relapsing fever*. According to Zuelzer's investigations, abortion is almost universal, while Weber in St. Petersburg (*Berliner Klin. Wochenschrift*, vii., 1870, p. 22) only saw premature labour in 23 out of 63 pregnant women suffering from relapsing fever. This difference in the character of the three continued fevers is undoubtedly connected with the unequal tendency to hæmorrhage, a tendency which is very slight in typhus. Not only has the latter the least influence on pregnancy, but its prognosis is least affected by the latter as well as by labour; while in enteric fever especially the danger is increased to a considerable degree by the co-existence of pregnancy.

§ 261. The opportunity of observing *intermittent fever (malarial infection)* in pregnant and lying-in women is rare, although of course commoner in malarious districts; if in the latter pregnant women are not attacked in the percentage which corresponds to their number, this is merely due to the fact that they are less exposed to the influence of malarial poison, especially during the later months. There is no reciprocity as regards the influence of malarial infection and pregnancy; abortion does not take place in consequence of the former, and pregnancy progresses to its normal termination, whether the disease has been previously got rid of or not. The latter is as a rule acute, or shows itself as an acute exacerbation of the chronic form. The use of quinine is almost always successful, and indeed essential owing to the suffering which the attacks of intermittent fever cause to women who are advanced in pregnancy; even large doses do no harm to a gravid woman, although they do not prevent a recurrence of the disease. The act of parturition cuts the acute form short, and stops the periodic attacks; this result being possibly due to the loss of blood. During the lying-in period however, *i.e.* during the first 3 weeks of it (especially in the second and third), an acute attack generally returns; and in women who are subject to the chronic disease, that period is a favourable opportunity for it to become acute. For since lying-in women moderately often suffer in malarious districts, although they can but rarely be exposed to infection, the frequency of the disease must be due to the remains of the chronic form being intensified. Whether this exacerbation depends on the fact that certain spots in the parturient canal have been wounded during labour, is an open question.

The course of an attack during the lying-in period is mainly characterised by the absence of intermissions, and by the disease giving rise to a continued fever with temporary and irregularly distributed rigors; at any rate the apyrexia is not perfect, and even in the cases which are clearly of an intermittent nature, the rhythm is no regular one. During the lying-in period, *quinine* must always be administered in *large doses*, since owing to fever and to the post-partum condition, digestion is at a low ebb and therefore only a portion of what is administered can be absorbed; but a satisfactory result will only be obtained, when the fever is due to malarial infection alone and to no other cause, and when the periods of apyrexia are perfect.

b. Icterus.

§ 262. Icterus deserves special attention, owing to the highly injurious influence which gestation may exert on its progress, *i.e.* owing to the intimate connection with acute yellow atrophy of the liver. Icterus is on the whole rare; I have only seen it 4 times amongst my own patients, and 3 times in consulting practice. In 2 out of these 7 cases, it turned to icterus gravis, to "atrophy of the liver" (one of the cases has been described by my former assistant Dr. Davidson). Its causes are the usual ones; it may moreover be produced by "tight lacing" (Virchow), through the lower half of the liver together with the gall-bladder being more or less completely reflected forwards and upwards during the growth of the uterus; but this is a rare occurrence.

So long as the jaundice runs the usual course, no special trouble arises, nor does the treatment differ from that which is appropriate in the non-gravid condition. The prognosis is always uncertain, since, as already mentioned, cases which are at first but slight, may prove serious and lead to *acute yellow atrophy of the liver*. This consists in a poisoning of the system by an accumulation of bile-acids in the blood, together with a secondary degeneration of the parenchyma of the great glands and of the substance of the muscles, especially of the heart. The reason why this severe poisoning is specially apt to occur during pregnancy (according to Frerichs, 11 out of 31 cases of acute atrophy were found in pregnant women, *i.e.* more than a third) is on the one hand that the renal circulation is not infrequently interfered with during pregnancy by venous engorgement (the kidney being the chief organ for regulating the excretion of bile-acids), and on the other hand that the blood is so often impoverished during pregnancy, thus giving the poison more opportunity of doing harm than at other times; to this must be added the fact that owing to the diminution of cardiac energy caused by the accumulation of bile-acids in the blood, the elimination of urine is still further lessened. The immediate cause of the outbreak of the severe symptoms is however generally a loss of blood, the intimate ætiological connection of which with the development of those symptoms in jaundice is well known; in the cases we are considering, it is a hæmorrhage from the uterus possibly due to the blood-poisoning or to abortion or to the labour (which is generally premature but may be at the full time), these latter events again being caused by the death of the fœtus in consequence of its blood being poisoned with bile; the latter fact is placed beyond doubt by the discovery of bile pigments in the fœtal tissues, in the placenta and the liquor amnii, and by that of bile acids in the fœtal blood (Valenta).

It must however not be forgotten that acute yellow atrophy of the liver in pregnant women may often be merely a symptom of phosphorus poisoning, and that this possibility must always be thought of first, whenever jaundice proves rapidly fatal. On the other hand, the supposition of a septicæmia being the cause of death in the cases referred to here must be negatived, since the icterus in such cases presents entirely different symptoms, and is almost only observed in lying-in women. If it is objected to the description here given of the nature of acute atrophy, *i.e.* in considering it a *result of a simple resorption icterus*, that in a number of instances of icterus gravis no mechanical hindrance to the discharge of bile could be found, I may point out that a very slight obstruction may suffice to interfere with the discharge of bile from the minute hepatic ducts, and that such obstructions are often very difficult to demonstrate in the hepatic parenchyma. In the icterus accompanying pregnancy, special attention must be paid to encouraging and increasing the renal secretion.

c. Cardiac Diseases.

§ 263. Amongst the *acute diseases of the heart, pericarditis* during pregnancy presents the same characters as in the non-gravid condition. *Acute endocarditis* on the other hand, and especially valvular endocarditis presents to some extent the same tendency to assume a destructive character, as does this disease during the lying-in period; it is therefore more dangerous

ıe more slowly progressive affection which occurs apart
regnancy, and which is generally accompanied by plastic
ısatory changes.

ıen suffering from *chronic diseases of the heart* however
greatly imperilled by pregnancy and the lying-in condition,
ıe changes compensatory of the cardiac lesion, which are
nt for the ordinary state of things, no longer suffice for
ssure relations when altered by pregnancy, and often
ddenly so by parturition, and under which the heart has
y on its work. By the intercalation of the placental
r area between the uterine arteries and veins, the resist-
pposed to the blood in the aorta increases, and with it
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first of all the pressure in the aorta falls, and the venous
becomes relatively over-filled by the closure of the great
and utero-placental vessels. Owing to this and also to
t (tending in the same direction) that the diaphragm
h the emptying of the abdominal cavity) has now a
range of movement, more blood enters the thorax and
gs after delivery, and the work for the right side of the
increased. This disturbance in equilibrium would soon
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in which it does so will depend chiefly on the seat of
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Women suffering from *chronic diseases of the heart* however may be greatly imperilled by pregnancy and the lying-in condition, since the changes compensatory of the cardiac lesion, which are sufficient for the ordinary state of things, no longer suffice for the pressure relations when altered by pregnancy, and often very suddenly so by parturition, and under which the heart has to carry on its work. By the intercalation of the placental vascular area between the uterine arteries and veins, the resistance opposed to the blood in the aorta increases, and with it the amount of work which the heart has to perform. This is rapidly altered when the placental circulation is arrested at birth; first of all the pressure in the aorta falls, and the venous system becomes relatively over-filled by the closure of the great uterine and utero-placental vessels. Owing to this and also to the fact (tending in the same direction) that the diaphragm (through the emptying of the abdominal cavity) has now a greater range of movement, more blood enters the thorax and the lungs after delivery, and the work for the right side of the heart is increased. This disturbance in equilibrium would soon be made good by a healthy organ, but may cause great confusion where the mechanism of the heart is disordered; the period and manner in which it does so will depend chiefly on the seat of the lesion, on the degree of compensation which has already taken place, on the structure of the cardiac muscle itself, and on other changes in the vessels of the great and small circulatory systems and in the lungs, and on the composition of the blood. The varieties that may be met with here are endless, but, speaking generally, the following remarks hold good for the commonest anomalies.

When the *aortic valves are incompetent*, serious disorders of the circulation usually show themselves even during pregnancy, especially during the second half, since frequently, and more particularly where the disease is still of recent origin, the amount of compensation is not sufficient for the increasing obstruction in the arterial area. The attacks of dyspnœa and irregular cardiac action may lead to premature labour; the symptoms attain their greatest severity during parturition, but when this is over and the blood-pressure has sunk, the symptoms subside and apparent convalescence rapidly sets in.

Incompetency and for the most part co-existing stenosis of the left auriculo-ventricular orifice need not cause any special trouble, when the disease is old and has been compensated by hypertrophy of the right ventricle, when the distention of the abdomen is slight, and when the increased arterial tension is immediately reduced to the normal level by the loss of blood during delivery. Where however the pulmonary channels are permanently engorged by the regurgitation, its consequences may show themselves gradually or suddenly during pregnancy (especially during the last months) by alarming symptoms (dyspnœa, extensive pulmonary catarrh, general œdema, albuminuria, ascites, pleuritic effusion), if any complications or additional difficulties still further interfere with free respiration and with the circulation through the lungs. But when the disease develops slowly, the compensatory changes in the right ventricle may take place to such an extent even during pregnancy that the ill effects are for the time being overcome without special accident, and the symptoms rapidly subside at birth. The symptoms of engorgement during pregnancy may indeed be entirely absent under favourable conditions, or only show themselves in a slight degree, and after labour prove all the more threatening; this is especially true of comparatively recent mitral lesions. Under such circumstances the right ventricle may be unable to pour the blood which is being copiously supplied by the veins of the body, into the pulmonary arteries in sufficient quantity, especially as a regurgitation from the left side of the heart into the pulmonary veins is taking place. A turbulent action of the heart, serous transudation into the lungs, insufficient oxygenation of the blood become super-added to each other, and in this way or by embolism, death may rapidly supervene. In cases that run a smoother course, catarrh, dyspnœa &c., yield to suitable treatment, and equilibrium is soon restored with the help of the discharges which take place during the lying-in period.

As regards treatment, it will be gathered from the above statements that in pregnant women whose aortic valves are diseased, the cardiac activity must not be lowered nor must the pressure in the vessels be increased; digitalis therefore must not be administered. A quiet life, saline purgatives, venesection in severe disorders are indicated; sometimes also the induction of premature labour, since, as has been shown, the emptying of the uterus has often a beneficial effect. This operation may also appear to be indicated in mitral disease, but never where mitral incompetency has not yet been fully compensated for, nor where the increase of blood-pressure and pulmonary hyperæmia which accompany labour will be dangerous. In these cases digitalis in small doses may be used with advantage, for it increases the pressure in the aortic system, diminishes the frequency of the pulse, and is a true tonic; if the lungs are abnormally engorged, an effectual venesection should be carried out without delay.

Fritsch explains in a different manner the influence of puerperal processes on a diseased heart; according to him the alarming symptoms which so readily set in after parturition, depend on an accumulation of blood in the great vessels of the lower abdomen, due to a fall of the intra-abdominal pressure, and to the consequently inadequate filling of the diseased heart. I admit that Fritsch's explanation suits certain cases, but it certainly does not all, for the lowering of the intra-abdominal pressure has not been shown to exist in all cases; nor can his view explain why severe symptoms so often occur during pregnancy.

d. Diseases of the Respiratory Passages.

§ 264. Chronic diseases of the air passages, especially of the lungs, in which the respiratory surface is diminished, may be affected by pregnancy and labour, much in the same way as is a mitral incompetency that has not undergone compensation, and this is especially true of extensive emphysema of the lungs. Amongst *acute* diseases, true *pneumonia* is a highly dangerous complication. It is rarer in women generally than in men, but above all is rare during pregnancy; women show a greater mortality from the disease than does the other sex, and this mortality is particularly high during pregnancy. In these cases the frequency and mortality at the different periods hold a similar but converse relation; during the earlier months, pneumonia is more common but less dangerous, the opposite being true of the later months. Pregnancy is not infrequently interrupted, and will be so with all the more likelihood, the further it has advanced; this is due partly to the inadequate aëration of the maternal blood and to the lessened supply of blood to the left side of the heart partly to the death of the fœtus, which was primarily caused by it and by the febrile temperature. Labour often has a prejudicial influence owing to the increased demands it makes on the already heavily taxed heart, to the increased pressure (explained above) in the venous system, and to the lowering of the aortic pressure which follows on delivery. The prejudicial influence which is associated with labour, is more frequent and marked, the further pregnancy has advanced. It will be obvious therefore that generally speaking the induction of premature labour is not to be thought of, either at the beginning or at the height of a severe illness[1]. Medicinal treatment does not differ materially from that used apart from the puerperal state; but I must point out that digitalis is of special value in these cases, and that venesection should be practised when threatening symptoms are present, although it must of course be borne in mind that collapse may come on after it, and after the labour which not infrequently follows on venesection; if such should occur, restoratives must be freely used.

The above remarks relating to pneumonia, are in the main true of severe *acute pleurisy;* it is accompanied by special risk at the time of labour, all the more so when there is a co-existing hyperæmia of the lungs.

§ 265. As regards complications due to a *chronic broncho-pneumonia or tuberculosis,* the view was long held that pregnancy afforded an immunity against such complications, and that if it commenced while such a disease was present, the latter would run a milder course, and in some measure become latent, while on the other hand parturition rapidly aggravated the disease. The latter idea is as true as the former is false, although it cannot be denied that occasionally disorders which existed previous to pregnancy do appear to be alleviated, the latter reaching its end without any very great discomfort. How slight a protection is afforded by pregnancy, is shown by the fact that acute tuberculosis may develop during it, and run so rapid a course that death occurs before the termination of pregnancy; extremely dangerous pulmonary hæmorrhages have also been observed in pregnant women.

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[1] Fischl has compared the 21 cases collected by Gusserow in which premature labour was induced on account of pulmonary disease, with 21 others in which an expectant treatment was pursued; of the former 15 women died, of the latter only 3.

In the majority of cases of pulmonary tuberculosis occurring during the gravid state, the disease appears to have developed but shortly before the commencement or during the progress of gestation, for conception is an exceptional occurrence, where phthisis is already advanced. The influence of hereditary predisposition is especially well seen here, being particularly favourable to the outbreak of the disease during matrimonial life, during pregnancy and even after delivery. Such women sometimes continue in good health during the first or even the second gestation, and only fall a prey to the inherited diathesis in a subsequent pregnancy. The lying-in condition has a still more injurious influence where disease is already present, or a predisposition exists, and it much oftener accelerates the fatal end; there are however exceptions to this statement also, and indeed the influence of the various puerperal stages on the development and progress of tuberculosis, is so variable that the conditions in each individual case must be very carefully estimated.

Although pregnancy usually reaches the full term in spite of progressive tuberculosis, it is not rare for labour to come on some weeks too soon; abortion may also take place, and be as injurious to the phthisical woman as is the lying-in period after a premature or a full term labour.

The children of mothers whose tuberculosis has made progress during the pregnancy may be born healthy; but they are often weakly and badly nourished, and many of them perish during the first months of life from catarrhs &c. Out of those which continue to do well, many after a while become scrofulous, and doubtless not rarely tuberculous. Girls therefore who show distinct symptoms of pulmonary tuberculosis or inherit a disposition to it should be forbidden to marry; or at any rate the attention of parents should be drawn to the possibility of the germs of disease developing, or of a relapse taking place into a disease from which a girl had previously recovered. If a tubercular woman has safely passed through pregnancy and the lying-in condition, she must never even for a short period suckle her infant; happily the supply of milk is rarely sufficient to allow of her doing so.

e. Syphilis.

§ 266. Syphilis is unhappily not a rare affection in pregnant women. When the disease has been contracted at the fruitful coitus or during the course of pregnancy, and is therefore *recent*, it is followed by a rapid and extensive development of the primary symptoms; they are such as point mainly to a severe local irritation, *e.g.* œdema, abrasion of the epidermis, follicular abscesses, eczema of the external genitals and their neighbourhood, and even a destruction of deeper tissues. This feature is to be explained by the anatomical conditions of the genitals during pregnancy, and by their increased nutritive activity. The secondary and constitutional symptoms on the other hand are usually very mild; the glands become but slowly infiltrated; papules form on and about the sexual parts, and are seen in various stages of development, the portio vaginalis is diseased, squamæ appear on hands and feet. The mildness of the symptoms is probably due to the improved and more active processes of nutrition in pregnant women.

Constitutional syphilis has a very injurious influence on the fœtus, and in reference to this point the syphilis of the progenitor ranks first in importance. The child may perish early in the uterus, and abortion or premature labour follow; or it may remain alive, although then also it is generally born prematurely, is puny, syphilitic, and succumbs soon after birth; if the child looks healthy at birth, the disease may break out after some weeks or months, sometimes only at the age of puberty.

§ 267. Either parent may bequeath syphilis to the fœtus, the latter being *infected* at the time of impregnation by the ovum or the semen; infection is also possible *in utero* during the progress of pregnancy, when the mother has but recently (*i.e.* since conception) contracted the disease. We have therefore the following varieties of infection:

a. The mother is constitutionally diseased at the time of conception; in such a case the fœtus is usually expelled by abortion or premature labour, and is often macerated.

b. The mother is healthy, but the father is constitutionally diseased; in this case the syphilitic poison passes into the ovum with the semen. This mode of infection is usually the worst, although sometimes the fluids of a mother that is still healthy at the time of conception, appear able to some extent to "neutralise" the paternal poison, and the children are born apparently healthy, although as a rule somewhat puny; sooner or later however they are attacked by syphilitic affections. Under these circumstances the mother usually remains untainted, although we cannot disprove the possibility of her being infected by the syphilitic fœtus (*choc en retour*); when she is so, there are no primary symptoms.

c. The mother is only infected at the time of impregnation. If the progenitor is then constitutionally diseased, that which has just been mentioned under *b.* is applicable; but if the father is not yet saturated with the poison, the infection of the ovum of course does not take place at conception, but it is only the *syphilis which is contracted during pregnancy* that has to be considered. It is uncertain whether this can affect the fœtus; Kassowitz denies the possibility on the ground that the syphilitic poison does not pass through the placental partition walls. Others declare that it does (Sigmund); so that the point is still unsettled.

d. Inoculation of the fœtus as it passes through the parturient passages must be extremely rare, if it occurs at all. Weil (*Deutsche Zeitschrift f. Pract. Med.*, 1877, No. 42) records such an event.

e. If the maternal and paternal syphilis is latent at the time of conception, the virulence of the disease in the fœtus depends on the degree and on the duration of the latency. The children may be born in apparent health and sicken later on, or they may be born in a weak and premature condition, or intra-uterine death may occur and be followed by abortion. Not a few of the cases of so-called habitual abortion are due to latent, especially paternal, syphilis. On the other hand it must not be forgotten that as time elapses syphilis loses more and more the capacity of transmitting itself by heredity.

In view of the great danger to which constitutional syphilis exposes the fœtus, every pregnant woman that has contracted the disease must be subjected to a *course of mercury*: not only if diseased before the pregnancy set in, or if she becomes so at conception; but in cases also where she has previously borne children tainted by the father, or when the diseased condition of children that have been born, points to the continued activity of a poison that is more or less latent in her. In the latter case it is better *before* a woman again becomes pregnant, to subject both her and the father to a thorough anti-syphilitic treatment; but even in the opposite case a course of treatment that is undertaken early may be of great value. Mercury may be freely given during pregnancy, and if administered in time exerts the most salutary influence on its progress and on the preservation of the fœtus. The long experience at the Lourcine in Paris, and the observations made at Selbo (Norway) by Faye *inter alios* are proofs of this. The use of suitable inunctions, or the prolonged administration of small doses of corrosive sublimate is the best. Where however the mother has only contracted syphilis during the last months, it might be desirable, inasmuch as the child then runs no danger, for a time to adopt a palliative treatment, and only to undertake a thorough course of mercury during or after the lying-in period. Local secondary or primary affections of the genitals should, if possible, be cured so as to avoid any possibility of the child being inoculated during labour. But no very irritating or caustic remedies must be employed, since the former are apt to bring on premature labour.

f. Surgical Operations.

§ 268. Lastly, we must make some observations on the permissibility of the more formidable surgical operations during pregnancy. Such must be unhesitatingly performed in affections which directly compromise the life of the mother; also in cases where postponement damages the prognosis of the disease which calls for the operation; further in all cases where the pregnancy itself seems to be causing a greater and more rapid development of the malady. But when no such argument for an operation exists, the latter must be postponed until after labour; for though in the majority of cases pregnancy is not interrupted after accidental injuries or after operations, still it is by no means rare for it to be so (according to Cohnstein's statistics, no interruption occurred in only 54·5 per cent. of all cases). The disposition to such interruption appears to be especially great in the first and last months; moreover an operation undertaken during what would be the menstrual period of the woman, were she not pregnant, appears to favour it. The interruption is due to reflex irritation or to the loss of blood, or is a result of the traumatic fever or of the secondary septic mischief. Operations on the generative organs are particularly apt to shorten the duration of pregnancy, especially those on the external organs and the vagina, much in the same way as apart from pregnancy they frequently accelerate the onset of menstruation, or at any rate give rise to uterine hæmorrhage. During pregnancy moreover it must be remembered that the hæmorrhage is usually very profuse owing to the enlargement of the vessels in and about the generative organs, that it is difficult to arrest on account of its venous and capillary origin, and that the application of compresses and of styptics which is usually necessary disposes to suppuration and to the development of phlegmonous processes, while the wide blood- and lymph-vessels favour a general infection. It is moreover desirable not to operate too soon after parturition, owing to this tendency to septic mischief.

g. Death during Pregnancy.

§ 269. A pregnant woman may die after a more or less prolonged period of illness, or quite unexpectedly. This sudden death is most frequent during or soon after labour, but it also occurs during pregnancy in consequence of latent cerebral affections, and especially owing to cardiac disease and embolism. The question arises what treatment should be adopted in these cases.

In olden times it was directed by law that before the corpse of a pregnant woman was buried, Cæsarian section should be performed (*lex regia* of the Romans), and in most countries it is still at this day ordered that the burial shall not take place, till the necessary measures have been taken for saving the child which is still *in utero*. We may here pass by the considerations which in earlier days influenced canonical injunctions that every such infant should be baptized, and also those which required the delivery of a fœtus which was not yet viable, so that we need only concern ourselves with the proper procedure, in cases where the mother dies after the 28th week and the child is alive.

Since we are merely concerned in saving the child, the latter must be delivered in the way which exposes it to least risk, that is—apart from the rare cases in which sudden death occurs during the second stage of labour—by *Cæsarian section*[1]. The latter, if it is to attain its object, must be performed very soon after death; for when the mother ceases to live, the child of course is rapidly asphyxiated. Generally speaking, not more than ten minutes must elapse between the death of the mother and the extraction of the fœtus, although there are instances on record in which living children were delivered after a greater interval and *recovered*[2]. Under these circumstances the diagnosis of the death of the mother is of the highest importance, for the operation may not only be done too late, but too soon; melancholy cases have been published, in which pregnant women who were merely in a state of deep syncope, or suffering from an attack of severe and hysterical asphyxia, were awaked by the commencing operation. But it appears to me that with the help of our present knowledge and appliances, a rapid and immediate diagnosis that death has occurred cannot be difficult, and that a cautious practitioner may in the course of at most a few minutes place it beyond doubt. By means of auscultation we may rapidly and with even more assurance satisfy ourselves as to the living condition of the child; if it is obviously dead, the decision for or against an operation depends on the judgment of the medical man; where there is doubt, he must operate at once.

§ 270. It is much more difficult to arrive at a decision, when we find ourselves at the bedside of *a pregnant woman, who is at or near the point of death.* Cæsarian section usually only succeeds, where death has taken place suddenly, circulation and interchange between the fœtal and maternal blood till then going on freely; when the life of the mother ebbs away slowly, the fœtus generally dies before her life becomes extinct, and when that has happened, there is no object in the extraction; exceptions to this rule, *e.g.* the undoubted case told me by Hoscheck (*Arch. f. Gyn.*, ii., 1871, p. 118), and the similar one of Runge (Virchow's *Archiv.*, lxvi., p. 366) belong to the rarest phenomena. To wait for the death of the mother is therefore to sacrifice the child also; on the other hand to save the latter by performing Cæsarian section on the dying woman appears inhuman, and is repulsive for many reasons. Still in many cases the inhumanity is in reality only apparent, and looking at the question from a broad point of view, I cannot but agree with Loewenhardt (*Aphorismen zur Geburtshülfl. Chirurgie.* Berlin, 1871, p. 82), when he urges us in such cases to save what we can, *i.e.* to save one life at any rate, instead of carrying our wish to avoid injuring the second which is about to become extinct, so far as to allow the child also to perish. A conclusion should never be arrived at except after consultation with another accoucheur, nor should the step decided on be carried out except with the consent of the nearest relatives of the pregnant woman. I consider it a bad practice to attempt to avoid Cæsarian section by extracting the child *per vias naturales*, after forcibly dilating the cervix uteri. In a *pregnant woman* this latter operation is quite as severe as the former, while it is accompanied by far more risk to the child, whose life after all is the only one we can save, and offers less prospect of preserving it alive. The Cæsarian section must be carried out according to all the rules of our art, not only in the case which we have just discussed, but even when the death of the mother has been ascertained; this would be a superfluous remark, if the grossest errors had not been committed in this respect.

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[1] In Prussia the performance of Cæsarian section on a woman who has died during pregnancy, is left to the judgment of the medical attendant in the particular case.

[2] Amongst the more recent accounts of a Cæsarian section which was *longer* deferred, but in which the child was *saved*, I will mention the following:

Pingler, *Monatsschrift f. Geb.*, xxxiv., p. 244.
Brotherston, *Edinburgh Med. J.*, April, 1868, p. 930.
Nierop, *cf.* van Hasselt, *Die Lehre vom Tode u. Scheintode*, i., 1862, pp. 12, 13.
Buckell, *London Obstet. Transactions*, xix., p. 179.
Cleveland, *Amer. J. Obst.*, xi., p. 626.
Blatner, *Amer. J. Obst.*, viii., p. 160 (the child was extracted one hour after death in a state of asphyxia; of course it was not kept alive).

When we consider what a slight prospect there is of preserving a fœtus by extraction, in cases where the death of the mother has occurred slowly, and bearing in mind the difficulty already mentioned of performing the operation on a pregnant woman who is just dying, the suggestion presents itself of *inducing premature labour* with the view of saving the child (of course only when it is viable) in such cases of disease which, as far as medical knowledge goes, appear hopeless, and in which the death of the mother is expected to take place before labour sets in spontaneously. We are bound to admit that it is in but few instances that we have good grounds for pronouncing a judgment as to the entire hopelessness of a disease, or as to the period at which death will occur, and in not a few cases the condition of the mother will be aggravated by the induction of labour, while further it may appear barbarous to embitter the last days of the life of a sick woman by such a procedure; still I agree with Stehberger and Pfannkuch (*Arch. f. Gyn.*, i., p. 465, and vii., p. 173—75), who are also supported by Runge and Leopold (*ibid.*, xiv., p. 299) (the latter at the same time communicating an observation bearing on the question) in considering it more humane (since there is no longer any hope of the mother's recovery) to carry out any legitimate measures for the sake of the child, so as at least to preserve what we can.

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3. *Anomalies of the Sexual Organs.*

§ 271. The various anomalies of the generative apparatus, so ng as they do not interfere with ovulation and insemination, r prevent the ovum from imbedding itself in the uterine ucous membrane, may complicate pregnancy, and give rise to more or less troublesome and dangerous series of phenomena. o far as they interfere with labour, they will be described (*cf.* 243) in the next part, for the sake of completeness. Here we hall merely speak of those whose prejudicial influence makes self felt during pregnancy, or at any rate is very marked during hat state; they include failures in development, deviations in osition, new formations, inflammatory conditions, and injuries.

a. Failures in Development.

In this place we are only concerned with uterus unicornis, and the various forms of uterus duplex.

(1) *Uterus Unicornis.*

§ 272. By uterus unicornis is meant a complete development of one fœtal horn, while the other is more or less atrophied. The uterus which in such a case only represents half of the normal organ, forms an elongated, cylindrical or flask-shaped body, which is curved towards the side to which it belongs, and is continuous with its Fallopian tube. On the other side the uterine horn and the tube are completely absent, or there is a rudimentary horn with a tube; the horn may be solid, or contain a cavity which, in the slightest form of the malformation, opens into a cervical cavity which is common to that of the normal side. The ovary is usually present on both sides.

Both the normally developed and the rudimentary (if it possesses a cavity) horns may become pregnant. In the case of the latter, owing to the weakness of the parietes, rupture takes place between the 2nd and 4th month as a result of the pressure exerted by the growing ovum (*cf.* Extra-uterine Pregnancy). When the horn does not communicate with the cervical cavity of the well developed side (which is extremely rare), the pregnancy is brought about by means of the so-called *external migration:* either of the *ovum*, as when an ovum which originated in the ovary of the normal side is fertilised and taken up by the Fallopian tube of the abnormal side; or of the *semen*, which in such a case must pass out of the normal horn, and reach the ovary of the rudimentary side by means of the peritoneal cavity and fertilise an ovum of that ovary—processes which are explicable by the close approximation of the two uterine appendages, by the locomotion of the spermatozoa, and to which similar and constant phenomena in lower animals are analogous.

Pregnancy in the *normal horn* usually runs an undisturbed course, indeed such a horn may harbour twins. The course of labour is not interfered with, nor do any special dangers accompany the lying-in state; exceptions to these rules are very rare. The upper division of the horn, which is always delicately constructed, and whose walls gradually thin towards the point at which the Fallopian tube is inserted, may, when the ovum (placenta) becomes attached to it, in spite of the hypertrophy which accompanies gestation, by degrees become so attenuated that it gives way during labour, and rupture takes place (Moldenhauer). If the rudimentary horn has at the same time been greatly enlarged (and the non-gravid side always shares more or less in the hypertrophy of that which contains an ovum), it may be an obstacle to the child entering the pelvic inlet, as in the case related by Müller and Borinski. But these are, as already mentioned, extraordinary cases.

It is extremely difficult to diagnose a one-horned uterus during pregnancy and labour. Marked lateral deviation, the discovery of a somewhat enlarged horn on the other side, in some cases a delicate shortened and laterally inserted "vaginal portion" are aids to diagnosis, although they are not always present. The shape of the pregnant horn is not so exactly spindle-shaped, as to make it always distinguishable from an ordinary uterus containing little liquor amnii, nor does it become so during the pains.

(2) *Uterus Duplex and Vagina Duplex.*

§ 273. The double formation which depends on imperfect blending of the fœtal rudiments, where both sides are equally developed, may lead to the two halves remaining perfectly distinct, so that like the two portions of vagina duplex they are not in any way connected with each other (*uterus duplex separatus s. didelphys*); this condition is very rare, and only found where a cloaca is present, in which case the two vaginæ open separately into it. Again, the uterus may have two horns (*uterus bicornis*); here the duplicate formation may affect the whole organ (*uterus bicornis duplex*), and be associated with two separate vaginæ, each of which possesses a hymen, or with a single vagina and two "vaginal portions"; or the body of the uterus alone is double and the cervix single (*uterus bicornis unicollis s. simplex*). The division and divergence of the cornua may be considerable, or only just indicated, the uterine cavity being divided in a corresponding manner. There may therefore be no fundus uteri at all (when the division is complete); but the more the two horns unite into one mass, the more does the uterine substance which lies between the two cavities assume the function and shape of the fundus, till at last that portion merely forms a small wedge-shaped projection into the cavity, and externally only presents a depression which indicates the division (*uterus arcuatus*).

In another variety of duplication, no trace of a division is visible externally on the uterus, or at most only a faint longitudinal furrow can be made out along its middle line, the uterus being broader than usual; but the cavity is divided to a varying extent by a septum (*uterus septus s. bilocularis*). Sometimes it is divided from the fundus to the external os into two equal halves (*uterus septus duplex*), in which case the vagina also may be double; at other times the partition wall only exists higher up, the cervical cavity being single; sometimes the lower half of the uterine cavity, sometimes only a slight projection at the fundus indicates the division (*uterus subseptus*).

§ 274. Pregnancy has been seen in all these different forms of duplication, with the solitary exception of uterus didelphys; indeed with vagina simplex and uterus bicornis twins are not uncommon, although they must be extremely rare with vagina duplex. Pregnancy as a rule is not hindered in its progress, and the children are carried for the full time; the belief that where there is a duplex condition, pregnancy is more often terminated prematurely than with a normal uterus, has still to be proven. When one half is not impregnated, it usually, although not quite invariably, shares in the hypertrophy of the pregnant half up to a certain point, and in the formation of a decidua. When the vagina of one half is rudimentary and occluded, it may happen (as has been observed in two cases) that pregnancy of one side co-exists with hæmatometra of the other; in such circumstances the former is usually brought to a premature termination.

During labour irregularities are apt to occur especially in the form of delay; they depend upon the malformation itself, and are caused by the pregnant half diverging from the axis of the pelvis, or by the unimpregnated horn becoming prolapsed (it may however, as occurs where a myoma is embedded in the lower segment of the uterus, be drawn up high above the pelvic brim by the retraction of the internal os), or by the deficient development of the musculature at the apex of the horned uterus. During the placental stage, severe hæmorrhage may set in, especially when the placenta was inserted into the septum between the two halves. The functional independence of the latter, when both become pregnant, is shown by the fact that in cases where the two labours take place simultaneously, the contractions are to a large extent independent of each other, as regards the mode and period of their occurrence, and still more by the fact which has been mentioned in the chapter relating to multiple births (§ 204), that the two labours may occur at different dates. On the other hand it must be pointed out that when only one side contains a fœtus, the os of the empty half frequently dilates at labour and casts off its mucous membrane.

Where only one side is pregnant, the cephalic "lie" is the commonest (Schatz calculates the proportion of cephalic to pelvic presentations as = 21 : 2); where the division is but slight (the cavity resembling an ace of hearts), the cephalic lie appears less frequent than that of the pelvic extremity (5 : 8) where the cavity consists of two pouches formed by the uterine horns which converge and communicate freely, the transverse lie has been frequently observed (according to Schatz, in 10 out of 23 single labours). Where the lie is a longitudinal one, and the fœtus-containing cavity is spindle-shaped (whether the right or left horn is pregnant), the first position is the most frequent; where the cavity resembles an ace of hearts, and the lie is longitudinal, the back of the fœtus looks towards the empty horn (Schatz). When the division is incomplete, one horn may contain the placenta, while a by no means unimportant portion of the fœtus occupies the other horn; the latter has therefore first of all grown out of the placenta-containing horn into the common cavity, and on further development into the horn of the opposite side.

§ 275. The duplicate formation is not infrequently so ill-marked as to be overlooked, for it is doubtless much more common than would be supposed from the cases that have been published. Where the vagina is double, attention is directed to the malformation, and the *diagnosis* of the latter can almost always be made. In the first place a *complete* vagina duplex, if associated with a double external os uteri, is proof of the existence of uterus duplex; for although vagina duplex is found with uterus simplex, still in such a case the duplex condition is always imperfect, inasmuch as the partition wall does not divide the entire vagina equally into two lateral halves, but is only developed at certain parts, and is provided with only one hymen. When the vagina is single and the portio vaginalis is double, there is good reason to suspect a double uterus, especially if both "vaginal portions" should show the characteristics of pregnancy in a different degree; a mere division of the external os however by a thick sagittal band does not mean much, since it may only affect the lowest portions of the cervical cavity. It is not permissible to pass a sound into the half of the uterus which is thought to be empty, for (apart from other reasons) even where the diagnosis is perfectly clear, such a procedure might by irritating one side, cause contractions of the pregnant half.

External examination is of no great help, except in cases of uterus bicornis; it is useless in the different varieties of uterus septus. Where the two horns are very distinct, the lateral situation of one or of both pregnant horns is noticeable, although not always very obvious. Where a unilateral pregnancy is present, the empty horn may be easily overlooked, since it lies concealed behind the enlarged one, and since (as has been stated under "Uterus Unicornis"), the spindle shape of the latter is not very easy to detect. Where the pregnancy is bilateral, the furrow down the middle of the abdomen is characteristic; it separates two laterally situated pregnant swellings to a greater or less depth; both enlarged horns however may be pushed against each other by the abdominal walls, and come to lie almost parallel. The condition of things is made clearer when the uterus contracts, as it can be made to do during pregnancy, if desired, by means of external friction. The primary shape of the uterus then reveals itself; if the pregnancy is bilateral, the two horns diverge more if unilateral; the spindle shape of the pregnant horn usually forms a greater contrast with the ordinary triangular shape of the uterus, while the empty one is drawn up as the internal os rises, and can be more easily felt.

These signs, confirmed by the way in which both sides share in the contractions, and by the course of the round uterine ligaments which can easily be made out, establish the diagnosis. After delivery, when the abdominal walls become very lax and the vagina is patulous, there can no longer be any difficulty in recognising the anomalous shape of the uterus.

Treatment in all malformations of the genital canal is restricted to symptoms, and must be guided by the disorders to which the abnormality gives rise. Any septa or bands of the portio vaginalis or vagina, which delay the fœtus during parturition, should only be divided when it is absolutely necessary; in many cases they are pushed to one side. It is however always better to cut them through at a selected spot than to allow them to be torn by the pressure of the presenting fœtal parts.

b. Displacements.

(1) *Prolapse of Uterus and Vagina.*

§ 276. Prolapse of the generative organs is very rare, except where it existed previous to conception. For though the hyperæmia and the hypertrophy of the vaginal walls associated with pregnancy, might tend to increase any descent that existed, the gradual ascent of the uterus which so soon follows will counter-act any such tendency; the descent of the uterus at the beginning of pregnancy which has been so generally accepted, is, as we now know, not a fact (*cf.* § 66). Prolapse therefore, if not antecedent to pregnancy, can only take place suddenly during that state through a shock affecting the whole body, through violent action of the abdominal muscles and where a predisposition exists, and this mode of origin is as rare in the gravid as it is during the non-gravid condition. Indeed with advanced pregnancy, this displacement is no longer possible. The pelvis is not roomy enough to allow the bulky uterus (which moreover is supported during any shocks on the pelvic brim) to pass through it. It must moreover be remembered that the severest forms of prolapse (procidentia) are by no means favourable to conception, and that when the latter takes place it usually only does so when the organs have been replaced; moreover advancing pregnancy is an important means of retaining them *in situ*. It will thus be readily understood why compared to the frequency of prolapse in women generally, this displacement is rarely met with in pregnancy. Most of the cases which are described as such, are doubtless due to prolapse of one or both vaginal walls, and to an elongation of the cervix either *in* *toto* or in its intra-vaginal portion. These displacements are for obvious reasons commoner in multi- than in primiparæ.

§ 277. In this form of displacement the *course of events* is usually as follows: (1) The prolapse, as already mentioned, d[illegible]isappears with the increase in size and the rising up of the uter[illegible]us, some descent of the vagina at most persisting. But (2) it m[illegible]ay also be that the organ lying with its cervix outside and in [illegible]he vulva, with its body in the pelvic cavity, is prevented from ris[illegible]ng up by injudicious practices, and attains such a size within [illegible]he pelvic cavity that the passage through the pelvic brim which is rendered necessary by the continued growth becomes impossi[illegible]le. This will especially occur when, as is so often the case, a ret[illegible]ro-version of the body of the uterus is associated with the prolaps[illegible]e; indeed commencing pregnancy favours such backward displac[illegible]e-ment, for the elongated supra-vaginal portion of the cervix which is so often atrophied where there is prolapse, cannot support t[illegible]he body of the uterus as it increases in weight, and when the uterus is low, the intra-abdominal pressure is exerted on its upper a[illegible]nd anterior edge and pushes it backwards. When this happens, t[illegible]he pregnant organ and its neighbouring parts become incarcerate[illegible]d, and abortion, peritonitis &c., and even the death of the moth[illegible]er may follow. (3) In rare cases the greater part of the prolapse[illegible]d uterus passes entirely out of the pelvis; and unless artificial [illegible]r spontaneous reposition takes place, pregnancy well be prematurel[illegible]y terminated, since a uterus inside an inverted vagina and asso[illegible]ciated with a displaced bladder can hardly continue to develop[illegible], till the fœtus reaches full maturity. With this view and th[illegible]e statement already made that prolapse cannot occur during th[illegible] second half of pregnancy, the fact accords that no well authen[illegible]ticated instance of the latter occurrence is known; for in the fe[illegible] cases in which it is stated that an uterus advanced in pregnancy or actually parturient lay outside the pelvic cavity, we are either not informed where the fundus lay, or else the latter was still in the pelvis; and still more frequently the protrusion in these cases was formed by the cervix. This is confirmed by the fact that the presenting part of the fœtus has never yet been felt during pregnancy in the prolapsed portion, such only happening during labour.

The future course of a prolapse occurring during pregnancy depends on its degree, on the width of the pelvis, and especially on the condition of the woman. As a general rule it causes but little discomfort, and what there is, is similar to that met with apart from pregnancy; at most are the dragging sensations more marked. If we except the cases in which incarceration takes place, abortion and premature labour are not so common, as might *a priori* be expected; when they occur, it is usually owing to mechanical violence or to interference with the circulation in the uterus.

§ 278. The main object of *treatment* must be to favour spontaneous reposition by advising the woman to avoid all severe exertion, by keeping her bowels freely open, and by forbidding her to hold her urine too long. The prolapsed organs must always be returned to their position in the pelvis, and be retained there by a perinæal bandage and a tampon of cotton wool dipped in glycerine. A fresh tampon should be inserted every day and removed at night, but if such a procedure is too irksome, a simple gutta-percha ring may be substituted; I prefer the tampon however, since the ring irritates the vagina and the portio vaginalis, and is usually pushed down by the bulky organs to such an extent that even when a ring is used, a perinæal bandage is also required. After the fourth month, the latter alone will suffice. If the patient is not seen till symptoms of incarceration have appeared, the bladder must be emptied, chloroform anæsthesia induced if necessary, and the uterus returned to its place in and above the pelvic brim, care being taken that the body of the uterus is not forced against the promontory so as to produce a retroflexion. If the prolapsed parts are greatly swelled, and reposition cannot at once be effected, the attempt should be renewed at intervals, superficial scarifications of the lips of the os and warm fomentations being meanwhile tried for reducing the swelling. If even then reposition does not succeed, an expectant treatment must be adopted, till the incarceration compels us to resort to interference, which of course means diminishing the size of the uterus by emptying it, *i.e.* by artificial abortion. This is better than waiting for the latter to take place spontaneously.

Prolapse mainly interferes with *labour* owing to the unyielding condition of the lips of the os, and to their impaction between the presenting fœtal parts and the anterior wall of the pelvis; of this we shall say more further on. As far as the prolapse itself is concerned, our object must be first of all to replace what is prolapsed, if it is still (partially) so, and to retain it *in situ* by a perinæal bandage; if this is found impossible, warm fomentations should be applied to the parts. During the pains counter-pressure in an upward direction should be made and the action of the abdominal muscles restrained as much as possible, since their contractions tend to increase the prolapse and incarceration of the lower segment of the uterus; indeed it is possible for the uterus when diminished by the discharge of the liquor amnii to be to a great extent pushed out of the pelvis. When such is the case, as also when the mischief is less severe, delivery should be undertaken as soon as it appears at all necessary and permissible. It will of course be obvious that during the so-called third period of labour, no traction must be made on the cord, that when that stage is over, the prolapse must be immediately and completely reduced, and that during the lying-in period the greatest watchfulness is necessary to keep the organs *in situ*.

§ 279. *Prolongation of the cervix,* especially of its *intra-vaginal portion,* must not be confused with prolapse; sometimes it becomes so considerable that the os uteri appears in the vulva. The condition is not a dangerous one, except where a false diagnosis is made; in the latter case attempts at reposition and the introduction of pessaries might lead to injurious irritation, flexion, inflammation and premature labour. Otherwise the condition is unimportant, and causes no trouble even during labour, except perhaps by a delayed softening of the lips of the os interfering with its dilatation. This softening however sometimes takes place even during pregnancy, and is dependent on the œdema consequent upon venous engorgement; it may be so marked that the portio vaginalis appears as a club-shaped doughy or even semi-fluctuating body, which keeps up a constant irritation, and may lead to premature labour. Rest, purgatives, and gentle scarifications of the lips of the os are the indications for treatment.

§ 280. *Prolapse of the vagina alone,* though rare, is commoner in pregnant women than that of the uterus during the same condition; this however only relates to the slighter forms, since the severer can scarcely occur without the uterus sharing in the displacement. Prolapse is almost always mainly confined to the anterior wall; generally the latter is alone affected, but in rare cases it is only the posterior. This displacement is especially troublesome, owing to the usually associated displacement of the bladder, and to the irritation of the vulva. The discomfort may be alleviated by attending to easy defæcation, cleanliness (tepid bidet baths), a perinæal bandage with or without a tampon of cotton wool. During *labour* the prolapsed anterior vaginal wall sometimes forms a more or less large swelling which appears at or even outside the vulva, and is pushed down by the descending head; owing to the pressure of the child it becomes very tumid, and, if it cannot be or is not replaced, may prove an obstacle to the progress of the head, or be torn off by the latter or contused and broken through, or be so squeezed as to become gangrenous during the lying-in period. The prolapsed wall therefore must, as long as possible, be pushed back over the head with the fingers, and held back during the pains, till the head has descended far enough to prevent a recurrence of the prolapse. Even when reposition cannot be effected, it is always advisable to hold back the prolapsed wall, and to push it up with the fingers during the pains, since under such circumstances the head will sometimes all at once glide out over the swelling. Where incarceration is already present, and the dangers which have been mentioned are threatening, the forceps may be applied with the object of avoiding them; and the traction must be so directed that the least possible pressure is brought to bear on the anterior vaginal wall, and the latter can sometimes be replaced during such traction.

(2) *Herniæ of the Uterus.*

§ 281. These displacements are rare at any time, but it is much rarer still for the dislocated organ to be impregnated, or for the hernia to come down after conception has taken place. Pregnancy is most frequently seen in an inguinal hysterocele (Hall Davis, *Obstetric Medicine*, 1836, ii., p. 912; Cazeaux, *Traité des Accouchements*, 7th ed., p. 728, Scanzoni, *l.c.*); next in simple umbilical hernia (Kennedy, *Obstet. Auscultation*, 1833, p. 40; Murray, *London Obst. Transactions*, 1860, i., p. 77; Léotaud, *Gaz. des Hopitaux*, 1859, No. 105); in a few older cases pregnancy is recorded in a hysterocele cruralis (Klob, *l.c.*); hernia uteri foraminis ovalis and hernia ischiadica have only been observed in the non-gravid state. The so-called hernia ventralis, in which the pregnant uterus is driven forwards between the abdominal recti muscles which have separated from each other, and causes the aponeuroses in the middle line with the general coverings and the peritoneum to bulge out into a sac, or does this at a median or laterally placed cicatrix of the abdominal wall, does not concern us here; it belongs to the so-called eventration of which we shall speak later on.

§ 282. An *umbilical hernia*, although existing before the commencement of pregnancy, can of course only contain the uterus when gestation has made considerable progress. In Kennedy's case the whole organ is said to have been situated outside the abdominal cavity, and to have hung down to the knees; in others the protrusion was not so considerable, reposition was effected and labour came on spontaneously. As soon as the displacement is detected, reposition must be made, relapse being prevented by an abdominal bandage, and a pad &c.

Inguinal or femoral uterine herniæ may be congenital anomalies, but are more often secondary and due to hernia of the ovary or to an entero-epiplocele in which these parts adhered to the uterus. Pregnancy terminates in abortion or premature labour, no instance being known in which a fœtus lying in such a hernial sac reached the full time; even the case recorded by Cazeaux (Ladesme in Salamanca, 1840—Cæsarian section) was one of premature labour. The diagnosis will depend on the history of the patient; on the shape of the body which is contained in the hernial sac and which grows narrower towards the ring and by the side of which the ovary can generally be felt; on the auscultatory signs; on the elongation and dragging of the vagina upwards and towards the side of the hernia, on the simultaneous displacement of the vaginal portion which is lying in the pointed fundus vaginæ and is greatly shortened, and on the absence of the uterus from its proper situation.

If the condition of things is recognised sufficiently early, an attempt should always be made to replace the pregnant organ, and when this cannot be done to induce abortion at an early date; for the latter almost always eventually comes on spontaneously, and after the discharge of the liquor amnii, reposition may possibly succeed, or labour may pass off successfully. If however the fœtus is already of considerable dimensions, there is but little probability of reposition or of a successful termination, and hysterotomy may prove necessary. It is not a good plan to allow the pregnancy to go on with the object of performing such an operation later on when the fœtus is viable, since as labour is always premature, there is but a slight prospect of saving the child. In cases however in which it appears necessary to perform Cæsarian section, it might be advisable with the view of avoiding it, to perform the operation usually practised for strangulated hernia and after enlarging the ring to return the uterus. The best way of inducing abortion is to puncture the membranes through the os; the introduction of a flexible metallic sound into the (at the same time anteflexed) uterus cannot prove very difficult, if its direction is clearly recognised.

(3) *Anteversion of the Uterus.*

§ 283. The natural inclination of the uterus forwards always appears to be greater during the first months of pregnancy than when the uterus is empty, and the latter may or may not retain its slightly curved shape. But pathological *anteversion* before the uterus projects well over the pelvic brim is extremely rare, and probably only occurs when the pelvis is very wide, especially in a sagittal direction, when the sacro-uterine ligaments exert strong retraction, when the anterior uterine wall is unusually thickened, and the intra-abdominal pressure exerted on the posterior wall is increased; it can therefore develop suddenly. The presence of *anteflexion* during pregnancy always presupposes such a displacement previous to conception. The symptoms resemble those in the non-gravid state, but the signs of pressure in the pelvis and of vesical irritation (hindered repletion of the bladder and consequent frequent micturition) are increased. The so-called incarceration is extremely rare; but when it occurs, there may be retention of urine due to compression of the region of the neck of the bladder, and the latter may ascend on one side of the uterus. Abortion does not follow unless there are simultaneous parenchymatous changes in the uterus, or unless the displacement has led to vascular engorgement of that organ.

When the displacements occur during the earlier months, they are rectified through the gradual and spontaneous ascent of the uterus; the mechanical discomforts are usually slight and may be alleviated by the dorsal position, by attending to easy and regular defæcation and by the use of a hypogastric belt. If the pressure symptoms are severe, the anteverted or flexed organ may be raised *per vaginam* above the anterior pelvic wall, and in some cases an anteversion pessary may be required.

§ 284. Anteversion during the later months gives rise to the so-called *pendulous abdomen;* it is always associated with a certain degree of flexion, the latter being generally developed in proportion to the pendulous abdomen; the lower portion of the anterior wall of the body of the uterus may form a great pouch hanging down in front of the anterior wall of the pelvis, while the cervix is still in the pelvic brim. The formation of pendulous abdomen is favoured and increased by great flaccidity and laxity of the abdominal wall; hence its severer varieties are seen in multiparæ; primiparæ however are sometimes affected by it, since their abdominal walls also may gradually give away under the intra-abdominal pressure. The principal cause is pelvic contraction, since this prevents the fœtus from descending into the pelvis, retains it wholly in the abdominal cavity, and prevents the lower portion of the uterus from becoming fixed in the pelvic brim. The pressure of the diaphragm and intestines now causes the uterus to move forwards (pendulous uterus), which it will do the more readily and extensively, the shorter the abdominal cavity and the greater the lordosis of the lumbar vertebræ. In the severest varieties the recti muscles are widely separated, giving rise to the above-mentioned *eventration,* in which almost the whole uterus lies in a sac formed merely of skin and fascia, and its fundus reaches down to the knees. Similar results may follow on any diminished resistance to the enlarging uterus, *e.g.* on cicatrices in the abdominal wall; thus eventration has been occasionally seen in the cicatrix left by Cæsarian section, by the incision in ovariotomy, and even in cicatrices lying at the sides and due to abscesses.

The troubles caused by pendulous abdomen or eventration are purely mechanical: pains due to the stretched abdominal skin, excoriation of the fold at which reflexion takes place, œdema of the lower portion of the abdominal walls, urinary troubles owing to pressure on the bladder, and difficult defæcation through want of a sufficient abdominal pressure. Progression is rendered very difficult, and the woman when erect is obliged o throw the upper part of her body far back in order to preserve er equilibrium. The only treatment which can be adopted, but hich almost always suffices, is to raise and fix the uterus by a ell adjusted, firm abdominal bandage, which holds the organ p and back, and offers it a firm support beneath the abdominal alls; at the same time it is well that the woman should use he abdominal muscles in moderation.

§ 285. During labour slight degrees of pendulous abdomen re spontaneously set right by the dorsal position and the action f the muscular fibres in the uterine ligaments; and if the pre-nting fœtal part is fixed in the brim of the pelvis, the fœtus mpels the uterus to assume a direction more or less approach-g the axis of the brim. In severer forms however the uterus is t infrequently driven far forwards by the abdominal pressure iaphragm), which in these cases acts entirely on its posterior ll, all the more so as the anterior abdominal muscles which ually counter-act such a displacement, have now lost all such luence. The os uteri is turned towards the promontory, the esenting fœtal part is likewise driven against it and, since the is of the uterus forms an acute angle with the axis of the im, does not enter the pelvis, or at any rate does not do so uare with the plane of the brim. If in these cases the body the uterus is raised till the two axes correspond, and is ed in this position, especially during the pains, matters will nerally be rectified, except where pelvic contraction prevents e head from engaging, and makes the use of other measures cessary.

§ 286. In order to complete the present subject, we may here ention that *the anterior wall of the lower segment of the uterus ay bulge down* in a similar manner to the so-called incomplete troflexion. The region in question is deeply pouched by the scending fœtal part, while the os uteri remains directed back-rds, or even near to the sacral promontory. The diverticulum wever is mainly derived from the stretched and elongated rvix, and causes it to be flexed; the body of the uterus which being retracted over the fœtus remains unaffected. The velopment of this condition is favoured by the axis of the erus lying somewhat behind the axis of the brim, by the wer end of the fœtus descending into the pelvic cavity before e pains begin, by the anterior wall of the cervix being prevented from retracting through its being compressed betw the fœtus and the anterior pelvic wall, and by premature rup of the bag of membranes. The anterior wall of the cervix b thus greatly stretched and jammed during the exit of the ch may be contused or even torn off. Indeed such cases as t have been so misunderstood that the uterus has been supp to be completely occluded and its bulging wall incised! W this condition is present, the woman should lie on her side avoid bearing down ; with patience and the use of morphia i tions, the anterior cervical wall will usually retract spontaneou the accoucheur may, if necessary, assist in its retraction over head, by drawing it forwards with two fingers during the p sometimes also during the interval between the pains. W the anterior lip is jammed, it may be requisite to mal sagittal incision, or even to extract the presenting head.

(4) *Retroflexion and Retroversion of the Uterus.*

§ 287. While the severest forms of anteversion or -fle belong to the second half of pregnancy, displacement backw is mainly a disorder of the first four months. It is usual "*retroflexion*", partly because this in itself is commoner "*retroversion*", and conception does not take place very re in the latter, and partly because when it does occur, the fla state of the uterine walls (which accompanies the hypertr and the serous infiltration of pregnancy) in conjunction the obstacles which prevent any great displacement of the c forwards and upwards, usually converts a version into a flex the displacement is in most cases neither exactly the on other, but the axis of the cervix forms a curve which is below, and the whole organ has the shape of a retort (fig. This distinction however is unimportant except for diagn We shall therefore speak of the condition under the n "retroflexion."

Displacement of the gravid uterus backwards presupposes existence of that abnormality before conception. In rare c doubtless a violent shock may cause it to take place sudde but if the position of the uterus has till then been normal size even by the 2nd to 4th month is opposed to such displ ment; so also will be the fact that any increased abdom pressure acts mainly on the posterior wall. The excessive repletion of the urinary bladder which in former times was so frequently accused of causing the retroflexion, may easily increase a displacement backwards which already exists, but can never of itself bring it about; in this matter cause and effect have been confused. In cases however in which the uterus is slightly inclined backwards, as so commonly happens when it lies low, the distention of the bladder may increase this inclination to such an extent, that a sudden rise in the intra-abdominal pressure may act on the anterior uterine wall, and all at once tilt the uterus backwards.

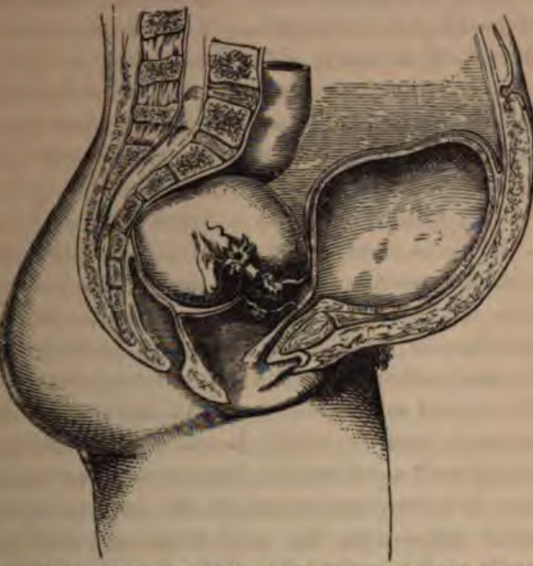

Fig. 61.—Uterus displaced backwards, diagrammatic. (After Schultze.)

§ 288. If the dislocated uterus is impregnated, the backward displacement is generally at first increased, in consequence of the swelling and increased size of its walls; all the symptoms which accompany such a displacement in the non-gravid condition, *e.g.* a sense of fulness in the pelvis, pain in the sacrum and thighs, difficulty and pain in defæcation, frequent micturition, as well as the so-called reflex symptoms, become intensified. The portio vaginalis is found behind or at the upper edge of the symphysis, the cervix is sometimes in a line with the body of the uterus, sometimes bent downwards; on a level with it is a firm, elastic, round swelling which fills up the recto-vaginal excavation, causes the posterior vaginal and the anterior rectal walls to bulge, and is continuous with the cervical wall; while the posterior part of the vaginal fornix is thus distended and pushed down, the anterior part appears as a narrow empty cleft which is drawn upwards. Abdominal palpation reveals the fact that the hypogastrium is empty, thus suggesting that the tumour which is filling up the pelvis may be the uterus; and a catheter introduced into the bladder shows that the latter can be pushed unusually far backwards. The displacement usually rights itself spontaneously with the growth of the uterus, generally slowly, sometimes in the course of a few days, as I have repeatedly seen. It is difficult to say how it does so, since the intra-abdominal pressure is adverse to reposition; but it must be remembered that the body of the uterus, as it enlarges in all directions, will grow in that in which there is least resistance, *i.e.* forwards and upwards; probably the muscular structures in the uterine ligaments also assist. Spontaneous reposition is facilitated by keeping the woman quiet and on her side as long as possible, by attending to easy defæcation and regular micturition. In not a few cases however abortion takes place; indeed retroflexion is one of the frequent causes of habitual abortion, and one which is not rarely overlooked. In bringing about such abortion, the hyperæmia accompanying the displacement and the engorgement of the decidua and placenta have a larger share than the mechanical obstruction to the actual growth of the organ; for it is clear that the diseased uterine mucous membrane plays an important part in causing abortion from the fact that it may take place even with the most quiet and careful *régime*, although it does so much more rarely than under opposite conditions. In a few cases I have observed that during the expulsion of the ovum, the retroflexion diminished and was converted into a retroversion (reclination), and that the latter persisted for some time after the emptying of the uterus,—evidence of the above-mentioned co-operation of the muscular fibres in bringing about spontaneous rectification.

§ 289. In a certain number of cases the uterus does not rise up out of the pelvis, nor does abortion take place, but the uterus continues to develop in the pelvic cavity. When this happens, the pressure symptoms described in the previous paragraphs gradually grow severer, fæces and urine are discharged with greater difficulty, the tenesmus increases, and forces the bulky uterus further and further downwards and backwards and the cervix against the bladder, till at last the uterus completely fills up the pelvic cavity, and seems to be immovably impacted in it (*incarceration of the uterus*). In rare cases this takes place more rapidly, when the intra-abdominal pressure has been suddenly raised, and with this difference in the mode of origin the symptoms also vary. The patient complains of severe pains in the pelvis and especially the sacrum, radiating down the thighs; the tenesmus is intolerable, and straining efforts only increase her agony. At first the pregnant woman may be able to pass some drops of urine, but soon this is found impossible, and the bladder rises to a high level in the abdominal cavity. The action of the bowels has been probably for some time already rendered difficult, by the extensive compression of the rectum and the hardness of the fæces to be evacuated; at last not even flatus can pass. The abdomen grows distended and sensitive, vomiting sets in and the temperature rises. The tenesmus and bearing down may become so severe that the body of the uterus descends to the floor of the pelvis, and covered by the posterior vaginal wall appears in the vulva, or even bursts through the vagina and shows itself uncovered (Grenser, *Monatsschrift f. Geburtskunde*, ix., p. 73; Mayer, *Presse Médic.*, i., 1837, p. 153); again, the anterior wall of the rectum may be protruded, and the fœtus make its exit through the anus (Halbertsma, *Monatsschrift f. Geburtskunde*, xxxiv., p. 414).

§ 290. But it is the bladder which presents the most dangerous symptoms, and for that reason as well as on account of the errors in diagnosis to which it gives rise, its condition deserves special attention. Thus it frequently happens that the retention is not complete, but that urine continually dribbles, or is passed at intervals in larger quantities, either voluntarily or involuntarily, while the bladder continues distended and may attain to an enormous size through the distention having occurred gradually. This *ischuria paradoxa* has but too often led to a mistaken diagnosis as regards the nature of the dilated bladder. *Cystitis* follows moderately quickly; owing to it and to the air which is introduced during the attempts at catheterisation, the urine undergoes decomposition leading to the so-called diphtheritic inflammation, even to gangrene of the mucous membrane and subjacent st The inner wall of the bladder, *i.e.* the mucous membrane, ei

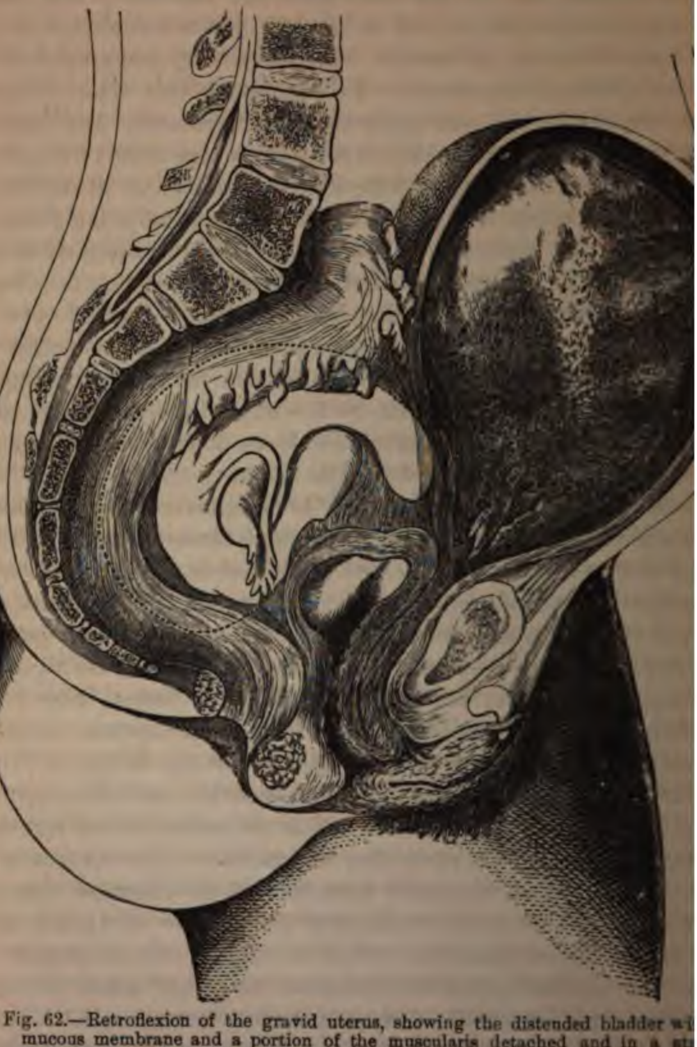

Fig. 62.—Retroflexion of the gravid uterus, showing the distended bladder w mucous membrane and a portion of the muscularis detached and in a st gangrene. (Schultze, *Arch. f. Gyn.*, i.)

alone or in combination with the innermost muscular layer, be detached in more or less large pieces, or even in its enti from its subjacent layer, and form a complete pouch lying in the bladder (fig. 62). The detachment begins at the vertex of the bladder, since the external pressure which opposes the distention is least at that point; moreover the serous coat and the external muscular layer allow of more stretching than do the inner muscular layer and the mucous membrane, so that the latter will reach their limit of extensibility soonest, and separate from the former. The detachment proceeds in the direction of the cervix, and at that point the loose sac is connected with the mucous membrane that is still adherent; here too when the former has been expelled, the regeneration of the inner wall will begin. Between the detached and the remaining layers, blood, pus and urine that has trickled through, accumulate. The gangrenous mass may lie over the neck of the bladder and prevent the urine escaping, even if the catheter gets into the bladder. Quite recently cases have been recorded in which several layers of the wall of the bladder and even portions of the peritoneum perished (Madurowicz, Hecker-Zantl), much as occurs in inversion of the bladder.

Rupture of the bladder is extraordinarily rare[1], even where the distention is extreme. On the other hand the decomposed urine and pus &c. may be absorbed by the bladder, while owing to the hindered emptying of the kidneys where distention is extreme, urine may accumulate in the renal pelves and in the renal parenchyma (the ureters do not undergo much dilatation), leading to *septic* or *uræmic poisoning;* this is one of the commonest causes of a fatal issue.

The latter may also take place from *peritonitis*, although this is rarer than is generally believed. The great distention of the abdomen, the pain when the bladder or the incarcerated uterus is touched, simulate such, or at any rate make it appear greater than it really is; where peritonitis is found at the necropsy, it usually accompanies septicæmia, or has started from an inflamed uterus. This *uterine inflammation* moreover with its sequelæ, parametric phlegmon and abscess, frequently causes death.

§ 291. This termination however is fortunately on the whole rare, for the symptoms usually become so severe before the situation is quite hopeless, that assistance is called in, and this can do very much towards obviating the worst. Even if the capital remedy, *i.e.* the liberation of the uterus from its incarcerated position, does not succeed, still spontaneous reposition will sometimes follow, if only the symptoms that are most urgent at the time, *i.e.* those due to the bladder and to the complete rectal obstruction, can be alleviated. If however the impaction is very firm, abortion usually follows, and it is remarkable how the uterus, though turned almost completely upside down, manages to get rid of its contents. With its diminution in size, the main object is gained, and if the injury done to the bladder, to the uterine tissues, to the neighbouring parts, and to the abdominal cavity is not too severe, complete reparation and recovery are still possible.

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[1] Quite lately Schwartz in Halle has described such an occurrence; *cf. Centralblatt f. Gyn.*, No. 6, 1880, where the author also quotes the scanty records of this occurrence.

It must yet be mentioned that the symptoms of incarceration may not show themselves so early as the 3rd or 4th month (as is stated above to be the rule), but somewhat later, viz. at the end of the 4th or the beginning of the 5th month. This is seen where the pelvis is very wide, the uterus relatively small, and the patient not of a very sensitive temperament. Indeed the pregnancy may run more than half its course, before symptoms of incarceration appear, the anterior wall of the uterus rising up out of the pelvis and continuing for a while to develop above it. Lastly, there are cases in which these symptoms do not show themselves at all, or do so only temporarily; this happens in the so-called *incomplete* retroflexion, of which we shall say more hereafter.

§ 292. It is usually easy to *diagnose* incarceration of the retroverted uterus. The symptoms already described are characteristic in a woman that feels herself to be pregnant, and the distention of the bladder strengthens the suspicion. Nor can it be difficult to detect the incarceration, if only the practitioner does not allow himself to be deceived by co-existing tympanites. If the bladder can be catheterised and emptied, bimanual examination will clear up the case; if the former cannot be done, the difficulty is greater. The physical signs are those mentioned in § 288, but are even more marked. The whole pelvic cavity is filled up by the body of the uterus, the perinæum bulges, there is œdema of the vulva, possibly of one or both thighs and of the gluteal region; the urethral orifice is drawn up behind the symphysis, the vagina is compressed against the upper border of the symphysis, the anterior vaginal wall ascends vertically towards it. The portio vaginalis is driven against the anterior pelvic wall, and can often only be reached with difficulty at its upper edge, sometimes not at all; now and then it can be felt from without, but care must be taken not to confuse a little tumour occasionally felt, and reaching several finger-breadths above the symphysis, with the portio vaginalis; this tumour is formed by the wall of the bladder, and persists after reposition. It is easy to mistake the distended bladder for the body of the uterus, the flexed organ for retro-uterine swellings impacted in Douglas' pouch, especially when these are associated with sudden pelvi-peritonitic disease, and the bladder cannot be emptied; but the consistency of the pregnant uterus and its contents is different from that of other swellings, and it may not infrequently also be recognised by the contractions which set in when firm pressure is applied to the body, either *per rectum* or *per vaginam*. When necessary, a thorough examination under deep chloroform narcosis will clear up the condition; indeed in urgent cases the tumour and even the bladder may be punctured with a fine trocar (and aspirated).

§ 293. *Treatment*. In view of the frequency of abortion and the great dangers of incarceration, the *spontaneous replacement* of the uterus is to be encouraged, whenever a woman with a retroverted or retroflexed uterus becomes pregnant, or whenever the displacement is discovered sufficiently early during pregnancy. This is done by prescribing a quiet mode of life, and the greatest attention to regular micturition and defæcation; to facilitate the latter, mild purgatives are alone to be used; not enemata, for the tenesmus which follows their use generally increases the displacement, while the injection usually does not pass beyond the fundus uteri. Rigid confinement to bed is only necessary, when signs of threatening abortion show themselves; in most cases a moderate amount of exercise may be allowed, but all exertion which requires vigorous action of the abdominal muscles is forbidden, and the woman must rest on the sofa in the latero-prone position for some hours at a time. It is a good plan, while the woman is in such a position, occasionally and *per vaginam* to push the fundus uteri up. I have never seen any harm done by the use of pessaries in these cases, but no good either.

If there is reason to fear the onset of abortion, *the uterus must immediately be completely replaced*. If impaction has not yet ensued, replacement *per vaginam* will generally succeed. It i effected by making the woman lie perfectly horizontal, with raise pelvis and flexed thighs, by introducing four fingers in supinatio and applying steady pressure to the body of the uterus in th direction of the promontory, and when it has reached the latter pushing the uterus past one side of it (whichever is easiest) int the great pelvis, while the other hand presses down the cervi from outside. The replaced organ must be brought into position of anteversion, and may be retained there by a Schultze or a lever pessary, till the danger of relapse has passed. This treatment is decidedly preferable to the introduction of small india-rubber bags into the vagina or rectum, as is sometime recommended, and which when distended exert a steady pressur upwards; the tenesmus which they provoke generally undoe whatever good they may have accomplished; and where they d succeed, the plan I have mentioned would have been mor effectual. I need scarcely add that during the whole of thi period, the pregnant woman must keep perfectly quiet in bed and lie as much as possible in the semi-prone position.

§ 294. If however we are dealing with a case of incarceratio the first thing to be done is to *empty the bladder*. This i usually not an easy matter, although it generally succeeds if th direction of the urethra is borne in mind; the point where th neck of the bladder is compressed must be sought for, and thick elastic catheter used, since it follows the occasionall tortuous course of the canal better than does a metallic instru ment; nor must it be forgotten that the seat of obstruction i often high up, that a dilatation may have formed below it, an that the instrument may have to be introduced very far. Some times the genu-pectoral position facilitates a proceeding whic appears impossible in the ordinary posture; or else the cervi uteri may be forcibly pushed (by means of several fingers in th vagina) backwards and downwards from the pubes, when th urine will sometimes at once flow off spontaneously; if thi proceeding is repeated and accompanied by external pressure o the bladder, the latter may sometimes be entirely emptied. B even if none of these plans for drawing the urine are successfu the attempt at *immediate reposition* need not be at once given u although of course the result can only be perfectly satisfacto when the bladder is emptied. Under these circumstances how ever (*i.e.* while the bladder is unrelieved) reposition will rarely succeed by the means mentioned above, so that in such cases of impaction it is better to make the attempt *per rectum*. The patient is to be put under chloroform, and two fingers, or half or, if necessary, even the whole hand introduced into the lower part of the rectum; while now the fingers of the other hand try to draw the portio vaginalis downwards and backwards, the body of the uterus is pushed obliquely upwards along one side of the promontory; occasionally reposition is greatly facilitated by the ventral posture with raised pelvis, or by the genu-pectoral. At any rate this mode of procedure will effect anything that can be effected, and makes other methods (introduction of levers, bags) superfluous.

Reposition may be rendered impossible by adhesions of the uterus in Douglas' pouch, by bands of adhesion above the uterus (Schatz, Moldenhauer *Arch. f. Gyn.*, vi.), or by inflammatory swelling and consequent absolute immobility of the organ. Undue force might do great damage by tearing the adhesions and injuring the uterus; no excessive violence therefore must be used in replacing the uterus. If the bladder cannot be emptied, it may be *punctured* between the umbilicus and the symphysis, ca. 8 cm. (3 in.) above the latter, so that the opening in it may remain in contact with the seat of puncture in the abdominal walls during the outflow of urine, and at the same time lie above the seat of compression. A fine trocar will suffice for the purpose. After the operation the uterus may sometimes be replaced, but if not, its size must be lessened by getting rid of its contents, *i.e. abortion must be induced*. When this is done, the symptoms are immediately greatly relieved; reposition may at once be found possible, or if not, as the uterus becomes contracted and involuted, the most urgent symptoms caused by the impaction disappear. Interference however must not be delayed, till the bladder, peritoneum or uterus are irremediably damaged. The *puncture of the ovum* is not always, indeed is rarely, an easy matter; it is all the more difficult the higher the portio vaginalis, the more firmly it is pressed against the symphysis and the more the uterus is "verted", as opposed to "flexed." For the operation it is best to use a uterine sound, which can be bent as required, or an elastic bougie through which a fine stilet can be pushed; if the portio vaginalis is directed straight upwards, the posterior lip may be drawn down with a tenaculum, and a metal canula sharply re-curved at its point introduced into the os, and through this an elastic bougie passed into the uterine cavity; even if the membranes are not at once ruptured by it, "pains" soon set in (*cf.* P. Müller, *Berliner Beiträge*, iii., 1874, p. 67). If these methods do not soon attain their object, the most prominent part of *the body of the uterus may be punctured* with a moderately thick trocar under all aseptic precautions; it must therefore be done from the vagina, although the fundus can be most accurately hit from the rectum; care must be taken to pierce the wall perpendicularly and not obliquely; the aspirator offers many advantages. The puncture of the uterus is not so dangerous as might appear, since the wound after discharge of the liquor amnii is soon closed by contractions; the canula should therefore be left in at least long enough for sufficient liquor amnii to flow off.

Displacement may be prevented from recurring after reposition, by suitable posture, by pessaries, by regular emptying of bladder and rectum; the sequelæ of incarceration are to be treated according to the usual rules. Since such incarceration may be fatal, even after abortion has occurred, I must here once again caution against interference being delayed till it is too late.

§ 295. *Incomplete Retroflexion.* As already mentioned, the displacements backwards are spontaneously rectified in a great many cases. But sometimes this only happens very gradually and imperfectly by the anterior wall of the uterus, which is least affected by the pressure of the neighbouring organs, rising up into the great pelvis and growing into the abdominal cavity, thus forming a secondary pouch in which the great mass of the fœtus comes to lie, while the posterior wall remains in the pelvis. These are the cases of incomplete retroflexion, *of retroflexion during the second half of pregnancy and labour, of sacciform dilatation of the posterior uterine wall,* of which we read in medical literature. Although as a rule the larger abdominal part of the uterus at last draws up the pelvic part with it and thus completes reposition, this may not be the case. Symptoms of incarceration may show themselves, even at a late period, where this condition of incomplete retroflexion is present; they may last but a short time, or be followed by premature labour. Pregnancy in this variety of displacement also is not infrequently terminated prematurely (it was so in 5 out of 11 cases collected by Veit), although it may last its natural time (as in 5 out of those 11 cases).

When parturition occurs in these cases, the pelvic cavity is found to be filled by a diverticulum of the posterior uterine wall, and this as a rule contains the head. The cervix is pressed firmly against the upper edge of the symphysis and does not move into the pelvic axis, so that the parturient canal does not attain its natural development (fig. 63); the bulging wall is greatly stretched downwards, and is occasionally broken through. In a few cases when the pains have lasted for some time, reposition has occurred spontaneously even at this stage, the os uteri

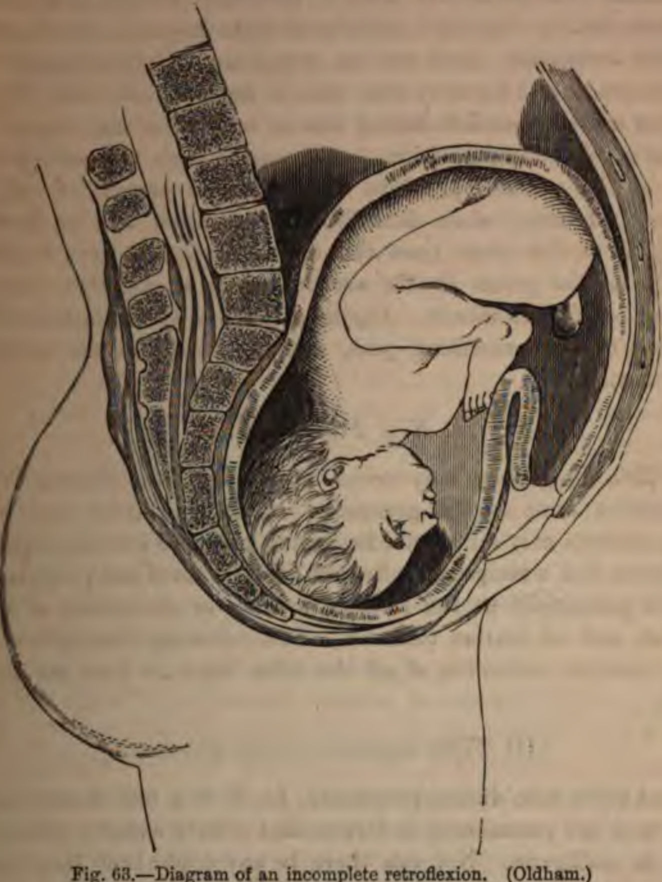

Fig. 63.—Diagram of an incomplete retroflexion. (Oldham.)

receding from its forward position towards the pelvic axis. But serious troubles may also occur when the bulging wall is not drawn up, or when, as occurred to Credé (oral communication), the placenta lies in the diverticulum and has to be removed by hand.

The *diagnosis* of this condition will not be difficult, if a careful bimanual examination is made; *treatment* during pregnancy must be mainly expectant, since apart from frequent dysuria and painful defæcation, there are no symptoms; gentle attempts at reposition should however even then be made at intervals. It is well as early as possible during labour, and while the woman is in the genu-pectoral position, *per rectum* to push the pelvic portion of the uterus up, while the abdominal portion is firmly pushed forwards; when difficult, the reposition will be facilitated, if at the same time the cervix is pulled towards the middle of the pelvis by the accoucheur or an assistant introducing his fingers into it. Digital dilation of the os favours the descent of the presenting part, and the disappearance of the irregularity.

c. *New Formations.*

§ 296. Pregnancy may occur where the most diverse new formations exist in the generative organs and their vicinity; such growths may all exert a disturbing influence on the progress of labour, but a reciprocal influence between them and pregnancy occurs principally in the case of myoma or carcinoma of the uterus, and of ovarian tumours. The following description is true, *mutatis mutandis*, of all the other tumours that are met with.

(1) *Fibro-myomata of the uterus*

are not often seen during pregnancy, for it is a well known fact that they are commonest in virgins and elderly widows, particularly in nulliparæ. Nor can there be any doubt that they may prove obstacles to conception; nevertheless impregnation sometimes takes place where from the size and position of the tumour it might be least expected, most frequently of course in the case of subserous and intra-parietal tumours, most rarely with submucous, as is easily explicable from a consideration of the relation of the latter to the inner surface of the uterus.

It is not uncommon for the swelling to share in the hyper- rophy of the uterus caused by pregnancy, for it to grow softer, nore juicy and bulky; thus I have watched a case (*Arch. f. Gyn.*, ., p. 110) in which a retro-cervical myoma which was scarcely oticeable previous to conception, had attained such a size, when abour came on at the full time, that in spite of the death of he fœtus Cæsarian section became necessary. The softening lepends on an œdematous infiltration, but dilated lymphatics nd lymphorrhagia are not rare, and may lead to the formation of ysts with or without hæmorrhage. Instances however are by no eans wanting in which the new formation undergoes no change hatever. The difference depends doubtless on the more or ss intimate connection of the growth with the wall of the erus, and on the varying abundance of muscular tissue and ssels. The myomata which become softened usually also dergo a change in shape, partly owing to the pressure of the dominal or pelvic walls, partly and principally owing to the agging exerted by the uterus, as it extends in different direc- ons. This change in shape is most marked in intra-parietal mours situated in the lower portion of the uterus; for these, the latter is stretched at the end of pregnancy and during bour, seem sometimes almost to disappear, so flat do they come; when the uterus is emptied and its wall retracted, they gain their original shape. Moreover an alteration in position ay take place, the tumour rising up with the body of the erus. The tumour may also be expelled during pregnancy (as ppened in a case of Cappie's).

Pregnancy frequently terminates in abortion or premature bour; especially when the myoma is attached to the lower lf of the uterus, since it is very apt in this position to prevent e symmetrical development of the uterine wall, and only rmits a certain amount of that development. Sometimes also ortion is brought on by the retroflexion due to a fibroid, still tener by the hæmorrhage caused by the growth. Not only is e placenta relatively often found in the lower segment of the erus (placenta prævia), but it may also be placed on the mour itself, and in these cases hæmorrhage seems to be par- cularly dangerous.

During the *lying-in state* (of the effect on labour more here- ter), the changes produced in the myomata by pregnancy usually retrograde; those of the latter that had become hypertrophied undergo atrophy to a corresponding degree through fatty degeneration and contraction, indeed they may become absolutely smaller than before, possibly also nearly or entirely disappear. Gangrene, suppuration in the tumour or in its capsule, often due to the pressure accompanying labour, may cause death, although they sometimes also lead to expulsion and recovery, after destroying the base or breaking through the capsule. Secondary hæmorrhages are not rare, and it is doubtless true that a myoma which is sessile at the fundus, predisposes to inversion of the uterus. In the last place it may be pointed out that occasionally the lying-in period offers the best chance for removing the fibroid by operation, either by enucleation or by excision, owing to the increased accessibility.

§ 297. The *diagnosis* of fibroids is sometimes easy; in many cases indeed the origin, size and consistence can be accurately determined. As a rule however there is very great difficulty, especially in the case of intra-parietal growths, since at any rate during the first four or five months, they often conceal the existence of pregnancy, or conversely the latter may conceal the presence of the former, so that the fibroid can only be recognised during or after delivery. Myomata which have become succulent and semi-fluctuating, may be confused with cystic tumours, and operated on (punctured), a matter which is not unimportant in the case of myomata. Fœtal parts (head), a second fœtus, a uterus bicornis have been mistaken for such tumours. Nothing but the most careful and repeated examinations carried out with the utmost circumspection, will prevent error; and although such examinations do not always entirely elucidate the case, they will at any rate prevent disastrous mistakes.

The *treatment* during pregnancy rests between removing the tumour, and terminating the pregnancy prematurely; apart from these measures we can but treat the symptoms. The *removal* of a sessile tumour is most easily accomplished where it is situated on the cervix, and is intra-vaginal, but inasmuch as the operation is sure to bring on pains prematurely, and can be carried out just as well, indeed even better, during *natural* labour, such interference is not advisable during pregnancy, except when urgent symptoms (hæmorrhage, gangrene of the tumour) leave us no option. Pregnancy must only be terminated by abortion, since premature labour is, or may be, accompanied by the same serious complications as is labour at the full term. It is however permissible, indeed imperative, to bring on *artificial abortion*, in cases where the pelvis is greatly encroached upon by myomata, which both by their situation (retro-cervical and -vaginal) and size seem to be irreplaceable, since the Cæsarian section, which will probably have to be performed under these circumstances, offers a most unfavourable prognosis for the mother. Abortion of course may be required by other kinds of tumours also, whenever they lead to great danger. When we are dealing with subserous myomata projecting into the pelvic cavity, it is a good plan not only where there are symptoms of incarceration but even without them, now and then during the last months to make careful attempts at reposition, in order both to guard against incarceration, to keep the tumour movable and possibly to elevate it permanently. We must also mention *extirpation by abdominal section* much as in ovarian tumours; it has been successfully performed by Schröder (*Zeitschrift f. Geb. u. Gyn.*, v., p. 397). *Extirpation of both pregnant uterus and fibroid* has lately been successfully accomplished by Kaltenbach (*Centralblatt f. Gyn.*, No. 15, 1880).

§ 298. The above remarks relating to submucous fibroids, hold good of pedunculated myomata (*polypi*), so long as they lie in the uterine cavity. These are especially dangerous owing to the hæmorrhage to which they give rise, and on that account and owing to mechanical interference with the ovum they generally cause abortion; inasmuch as they cannot be reached by the finger, they are only discovered at or after the expulsion of the ovum. Polypi *lying in* or projecting from *the cervix*, and which arise from the latter or higher up, cause even severer hæmorrhage, and, when of large size, may lead to mechanical troubles. If they are readily accessible, it is best to remove them, not with the ligature but with scissors, or if there is a risk of hæmorrhage with the écraseur. The small cellular cervical polypi, and they also may give rise to copious purulo-sanguineous discharges, and thus cause great weakness, are to be removed as soon as discovered; as caustics, I recommend fuming nitric acid, a solution of chloride of zinc or a red-hot ron.

(2) *Cancer of the Cervix Uteri.*

§ 299. Unhappily *cancer of the cervix* does not always
conception; it only does so, when the growth entirely o
the canal. Cancer of the body of the uterus is never o
during pregnancy.

The complication is a very grave one, for, if at all adva
seems materially to curtail the life of the patient, not
through the pregnancy, but through the laceration of the d
parts during labour. Now and again the progress of the
as well as its local and general symptoms, appear to
certain extent arrested by pregnancy[1], but this is excep
the rule is for the disease, much as in the non-gravid co
gradually to involve contiguous parts, and in the case
soft carcinomata even more rapidly, probably owing to th
changes in nutrition that are associated with pregnancy
actual duration of gestation is not shortened in the m
of cases; it is so more rarely, the more the disease is c
to the portio vaginalis or the roof of the vagina; and con
the more frequently, the higher the region of the supra-
portion of the cervix it has attacked. The irritation ca
interference with the physiological changes in the latter
owing to the cancerous degeneration may terminate th
nancy prematurely. On the other hand it is noticeab
pregnancy complicated with cancer now and again lasts
the usual period; no explanation of this fact is known, u
is that in a large proportion of these cases the pains whic
on at the proper time were rendered ineffectual by the
and hardness of the cervix uteri, and again became qu
the fœtus then dying and being retained for months as
or in part within the uterine cavity (*cf.* Depaul-Schmit, *A*
Tocologie, Feb. 1876, p. 111; *cf.* also *infra*).

The diagnosis is not affected by the co-existence of preg
In regard to *therapeutics*, the principles recommended apa

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[1] I have seen a small commencing epithelioma of both lips of the os re
changed from the 3rd month right on till labour at the full time, both as re
and shape; during labour it caused very little trouble, but afterwards gr
more rapidly. 8 weeks *post partum* I removed it with the red-hot wire. Q
I have had under observation an entirely similar case, which I first saw in
month of pregnancy; here also labour came on at the full time and passe
but little trouble, the growth being removed six weeks afterwards.

that condition hold good. I must strongly recommend the early removal of the growth, if it is still confined to the portio vaginalis (this has lately been successfully performed by Savory, Schröder, Benicke, Bidder, Wiener (*l.c.*) *inter alios*); when however such a proceeding is not possible, I must warn against undue local meddling, since this, unless radical for the time being at least (and apart from removal no treatment is so), does not diminish the danger accompanying labour, and on the other hand is apt to interrupt the pregnancy. Such interruption is always to be avoided, and artificial abortion or premature labour are therefore put out of the question; on the contrary, considering the hopeless prospects for the mother, all our efforts should be directed to preserving the child. Abortion destroys the latter, and in no way prolongs the life of the mother; indeed after abortion the disease usually spreads very rapidly. Premature labour has still less to recommend it; generally it has no object, since the injury done to the diseased parts is much the same as in a full time labour, and the preservation of the premature child is highly problematical owing to the difficulties of labour and to the interference which is rendered necessary (in one case in spite of premature labour, I was only able to deliver after craniotomy). The end of pregnancy must therefore be patiently awaited, and the treatment adopted which is recommended farther on. If the full term has arrived without labour taking place, or if now or shortly before this the symptoms in the mother have become very severe, pains may be encouraged so as to assist the mother and preserve the child. The further treatment should be that pursued in a spontaneous labour at the full time (*cf.* also § 269).

(3) *Ovarian Tumours.*

§ 300. This complication can hardly be called rare, as indeed is shown by those cases in which ovariotomy has been performed in ignorance of the co-existence of pregnancy. Moreover bilateral ovarian disease has been met with during pregnancy. The tumour in most cases existed previous to conception, although it was then usually of relatively small size. It may possibly begin to develop during pregnancy, but the question is still unsettled.

Pregnancy and ovarian tumour may co-exist side by side without causing any serious symptoms, and the pregnancy may terminate successfully. The tumour may remain stationary, or possibly even diminish in size (Milne, *Edinburgh Med. Journal*, 1874), an event which of course can only occur in the case of cysts, and is to be looked upon as a result of pressure exerted by the growing uterus. But often enough important changes in the new growth show themselves under the influence of pregnancy, and *vice versa*. This depends mainly on the nature of the tumour, its position, connection with the uterus, and mobility.

Pregnancy not infrequently favours the growth of the tumour by the increased afflux of blood to the generative organs, of which of course the ovaries receive a share; this is not merely true of cystomata, in which the rapid increase of the contents may cause the gravest mechanical troubles, but also and still more of the solid tumours. Thus I have on two occasions been able to examine bilateral cancerous growths soon after labour (*Monatsschrift f. Geb.*, xxx., p. 380; and Hempel, *Arch. f. Gyn.*, vii., p. 556), in which not a trace of healthy tissue remained, and in which therefore the disease must have made rapid progress during gestation. Moreover the danger of originally innocent growths turning into malignant ones, as now and again seems to take place, is quite as great as is the increased rapidity of growth.

Another series of dangers may depend on reciprocal interference with each other of the uterus and tumour. If the latter is fixed in the pelvis and not easily displaceable, the former may be subjected to severe pressure, indeed become retroflexed and thus lead to abortion; but this is rare. It is much more common for both to rise up into the abdominal cavity; and if so, it is the extreme abdominal distention which is the source of the trouble, all the more so if the cyst be rapidly filling at the same time; if now owing to interference with respiration and to irritation of the peritoneum, ascites is superadded, the situation becomes extremely grave. Nutrition may suffer greatly, and the patient be brought to a condition of extreme exhaustion before her pregnancy reaches its full term. The mechanical irritation sometimes leads to the formation of extensive adhesions, the pressure to rupture of the cyst and to a discharge of its contents into the abdominal cavity. Moreover a retrogressive

tamorphosis of the cyst wall consequent upon hæmorrhage
d suppuration (generally after puncture), may also lead to
h a discharge. Rupture is not always fatal; the fluid poured
may be absorbed and the pregnancy reach its normal dura-
n, but as a rule death takes place by collapse or else by
itonitis. In other happily rare cases, the uterus rises up
neath the tumour, twists both tumour and pedicle round their
s, and so strangulates them; death may then take place
ough hæmorrhage into the cyst and abdominal cavity, followed
peritonitis, but usually is rapidly brought on by gangrenous
nges in the tumour, sometimes by shock.

The influence of this complication on the progress of pregnancy
such, depends on the changes that have been mentioned, as
l as on the general deterioration in health which sets in; as
eady mentioned, when the tumour does not grow or does so
slowly, pregnancy often reaches its natural termination. The
elopment of the fœtus itself is not directly affected.

The lying-in state is rarely normal; this is chiefly due to the
our being generally difficult, and to severe operative inter-
nce being often called for. Special dangers follow on the
tusion to which the tumour has been exposed during labour,
the secondary inflammations and gangrenous processes in it,
ich, as I have seen, may also be produced by thrombosis in
tumour. A rapid increase of the new growth is likewise
n seen during the lying-in state.

301. From a *diagnostic* point of view, we should always be
picious when a patient suffering from an ovarian tumour, who
hitherto been menstruating regularly, ceases to menstruate
a considerable time, and when her abdomen grows somewhat
idly. If, as is the rule, both tumours lie side by side, it is not
easy matter to distinguish them. In obscure cases the re-
nition of the pregnant uterus is generally easier than that of
accompanying new growth; but this is not always so. The
rus, owing to adhesion of the tumour to the anterior abdominal
l or to its enormous size, may be entirely forced to one side, so
o be difficult to discover. Thus I examined and tapped a case
which the cyst filled almost the whole abdominal cavity, had
ed the uterus far into the right lumbar region and to some
nt roofed it in, while in the pelvis the only part of the uterus
could be felt was the portio vaginalis, which was displaced to

the right side and high up; it was not till auscultation had been practised on four different occasions, that the condition of things was cleared up. The diagnosis may be especially difficult with a multilocular and very nodulated new growth, when the uterus is firmly applied to it, and seems to form part of the growth. Conversely, the uterus may so conceal the tumour that its existence, and still more its nature, are utterly beyond recognition. But a very careful palpation, under anæsthesia if necessary, and a repeated auscultation, where there is any suspicion, will as a rule clear up the case, or at any rate prevent any disastrous mistake.

§ 302. Considering the great danger which this complication causes during pregnancy, and possibly still more during labour, it will at once be obvious that an expectant treatment is only admissible up to a certain point; only when the tumour is small, of slow growth, and where pregnancy progresses without any serious symptoms. Under opposite conditions, *i.e.* when the tumour is large to begin with, multilocular, or solid, or rapidly growing, something must be done, if possible of the nature of prophylaxis; for the success of any treatment that comes up for consideration, depends in no small measure on its not being delayed till the woman has been too greatly reduced by the complication.

What can be done? In the first place *artificial abortion* must be rejected, since while sacrificing the fœtus it is but of little use to the mother; it leaves her with the tumour and moreover under circumstances which favour its rapid and insidious development; the post-partum period supervening on abortion has often the same injurious influence as that after an ordinary labour. Our choice therefore lies between the artificial induction of premature labour, tapping the cyst, and ovariotomy.

When the contents of the tumour are mainly fluid, therefore with unilocular cysts, or with multilocular in which one cavity greatly predominates, *tapping* has much to recommend it. It has been performed a good many times, and (especially in the extensive experience of Sir Spencer Wells) appears not to be more dangerous than in the non-gravid condition; in a large majority of cases it allows the pregnancy to reach its normal duration, and therefore saves the child. I myself have twice performed this operation under urgent circumstances, without interfering with the pregnancy. But with other tumours than those mentioned, the operation must not be thought of; at any rate it can be of no use, and we are left to choose between *artificial induction of premature labour* and *removal of the tumour*. Since the former of these, considering the size of a viable child and its relation to the progress of labour, scarcely offers better prospects than does labour at the full time, while the mother is left with her tumour exposed to the injurious effect of the pressure which accompanies labour, and of the lying-in state, I cannot advise artificial induction as a general rule, although in any exceptional case it might conceivably be the best treatment, indeed the only one admissible when ovariotomy is declined. The latter operation is on the whole not so dangerous as would *a priori* be expected; it is least so for the mother, especially since the introduction of antiseptics; nor is it much more so for the continuation of pregnancy.

Ovariotomy has now been performed in a by no means small number of cases, sometimes unintentionally through error in diagnosis, but generally for definite indications. Sir Spencer Wells (*London Obst. Transactions*, vol. xix., p. 185) has operated 9 times, losing one patient; Schröder (*Zeitschrift f. Geb. u. Gyn.*, v. p. 383) 7 times, always with success; I myself 3 times with a similar result; others also have succeeded. In some cases it is true abortion took place after the operation, although without prejudicial influence on the woman. I must therefore strongly urge that the operation be performed under the circumstances above described; not only where life is actually endangered, but here as elsewhere without much delay, if the physician is convinced that such danger will eventually arise. According to the evidence before us, the mother will have a better chance, when the difficult labour that might be caused by the complication, is from the first made impossible; nor is the prognosis worse for the fœtus, since without an operation quite as many fœtuses perish during birth, as perish by abortion brought on by the operation. If however the latter is declined, we are compelled to resort to other treatment according to the circumstances of the case. Ovariotomy is imperatively demanded, indeed it is our only resource, in those cases in which the cyst has burst, or in which the symptoms point to suppuration or to twisting of the pedicle.

d. *Inflammatory Conditions.*

(1) *Metritis.*

§ 303. Acute metritis, that is parenchymatous metritis, is rare even in the non-gravid condition, and in my mind there is considerable doubt whether it ever occurs spontaneously during pregnancy; apart from the diffuse or circumscribed swellings which not infrequently accompany retroflexion, I have not seen anything approaching to metritis. Of course I except those cases in which products of metritis are found in a woman who has died *soon* after delivery; such belong to the puerperal diseases in the narrower sense of the word, and no longer to pregnancy. Cases however are on record in which the disease of the gravid organ led to abscesses, and even to perforation of the wall (rupture), and in which when the lowest portion of the uterus was involved, the abscess discharged into the vagina (Dezeiméris, "De la Rupture spont. &c., *L'Expérience, Journal de Méd. et Chir.*, 1839, No. 94; Kennedy, *Pathological Soc. of Dublin*, 1839). I must also call attention to the fact that sometimes small fibroid nodules of the uterine wall swell up during pregnancy, grow soft and sensitive, and may be mistaken for inflammatory infiltration.

Inflammation (due to irritation) of the *uterine serosa* is commoner, and leads to its thickening and to the formation of pseudo-membranes; but even this is rare, if we except those cases in which it is associated with incarceration or tumours. Old adhesions often get stretched without much difficulty during pregnancy, owing to the alteration in size and position of the uterus, and are then broken down. They are by no means such a frequent cause of abortion, as was at one time believed (Boivin).

Parametric inflammations and phlegmon in the lig. latum are somewhat commoner than similar conditions of the pelvic peritoneum; the causes are injury or effusion of blood into the cellular tissue. I have seen two cases, both terminating in abscess; one burst into the rectum, the other I opened below the right Poupart's ligament. In neither case was the progress of pregnancy interrupted. Treatment in all these inflammatory conditions must be guided by the usual rules.

§ 304. Sometimes the uterus, especially during the later months of gestation, is extremely sensitive to pressure and to the fœtal movements; indeed attacks of pain very similar to colic or to labour pains may set in spontaneously. This condition has been called *rheumatism of the uterus*. The pain may either be simply neuralgic, or accompanied by fever or gastric disorder; nor is it rare for the bladder and the lower part of the intestinal canal to be also affected. The severer forms of this affection, especially those associated with fever, are probably due to inflammation of the uterus, chiefly of its inner surface, and as a rule they soon bring on labour, which is often followed by severe disease during the puerperium. The slighter forms, which have more of a simple neuralgic character, are difficult to explain, but I see no reason why the word "rheumatism" should not be applied to them, since they are readily brought on by chills, and similar affections are met with elsewhere, *e.g.* in the bladder, and similarly described. The name indicates what we mean by the disease. These cases are to be treated with purgatives, *e.g.* ol. ricini (which do good even when there is no constipation), opiates, warm baths, warm fomentations on the lower abdomen, and diaphoretics. I have seen great good done by the application of flying mustard poultices to the lower abdomen, and by fomentations made by dipping flannel rags in hot water, and sprinkling them with some ol. terebinthinæ, by enemata of ol. ricini and ol. terebinthinæ (aa. one table-spoonful), and by subcutaneous injections of morphia in the abdomen.

(2) *Endometritis.*

§ 305. The commonest and (anatomically) the most easily demonstrated inflammatory condition affecting the gravid uterus is endometritis. In the form of an *acute* disease associated with destruction of tissue, it often accompanies the acute infectious diseases, as was described in § 257. As a *chronic* disease, it appears in two forms, endometritis hyperplastica and e. catarrhalis.

a. Endometritis decidualis chronica, hyperplasia of the decidua. The change is either uniformly distributed in every part, or is especially marked at certain spots, at which it leads to the formation of excrescences—endometritis decidualis tuberosa or polyposa.

§ 306. In the *uniformly distributed* variety, a partly fibrous, partly embryonic connective tissue of the nature of granulating tissue is developed, and thus gives rise to thickening and induration of the decidua; the subjacent muscular fibres may also share in the hyperplasia, and the formation of cysts has sometimes been seen. The disease may be confined to the placental portion of the decidua, but sometimes it chiefly affects the vera in its whole or in part of its extent; the reflexa also may be involved. The first of these situations will of course be most injurious for the fœtus, but even when the disease is extra-placental, early abortion is apt to take place owing to the incessant irritation and to the destruction of tissue by extravasated blood. On the other hand when the inflammation is moderate in extent and runs a slower course, or when the placental portion is not involved, the pregnancy may reach its natural duration; indeed the disease may not develop till the last months. In these cases labour may be complicated by difficulty in the detachment of the decidua; and if the placental portion also is diseased, the detachment of the placenta will be interfered with. The cause of this diffuse hyperplasia cannot always, indeed can only rarely, be made out with certainty. Syphilis may lie at the bottom, in other cases a chronic endometritis existed antecedent to conception and was carried over into pregnancy; sometimes, and especially when the malady sets in later, injury or over-exertion may be the cause (Kaschewarowa). In a few cases the hyperplasia is undoubtedly secondary, *i.e.* consequent on the death of the fœtus, and this appears to be most common in those cases in which the ovum remains quiet in the uterine cavity for a considerable time after its death (Duncan, *Researches in Obst.*, p. 293).

§ 307. The *polypoid* variety of endometritis decidualis, between which and the diffuse, transitional forms are found, is characterised in a well marked case by a two- to three-fold thickening of the whole decidua, on whose surface are situated bosses and excrescences of various shape and size, 1—2 cm. ($\frac{1}{3}$—$\frac{2}{3}$ in.) high, and with a smooth surface; sometimes they are polypoid in shape, sometimes more knob-shaped, situated on a broad base, sometimes merely thickened nodules. They are as vascular as, or even more so than the rest of the decidua; the glandular orifices are few, sometimes absent; they are often of small diameter especially at the apices of the excrescences. The hyperplasia is produced by decidual cells which are remarkable by their size and large nucleus; they lie concentrically round the vessels, and cause the narrowing of the glands. This hyperplasia in a few cases (Dohrn, *Monatsschrift f. Geb.*, vol. xxxi.) in which the vera was absent, has also been seen in the reflexa; but this has hitherto only been observed in the ova of early abortions. The chorionic villi are almost always thickened (secondarily) and hypertrophied, the embryo being usually shrivelled. Sometimes the cause is syphilis; where there is no reason to suppose such an origin, the explanation is generally unknown; the supposition that it is due to irritation preceding conception does not help us, both owing to its frequency and its vagueness, but it is possible that the mucous membrane may have been similarly diseased previous to pregnancy. The hyperplasia may often have no importance, and be secondary.

§ 308. *b. Endometritis decidualis catarrhalis* (Hennig), *hydrorrhœa uteri gravidi.* In this disease the inflammation of the decidua is slight, and leads not to hyperplasia, but merely to increased transudation and migration of blood-corpuscles. Hence arises the thin serous albuminous discharge which is occasionally present during every stage of pregnancy, but especially during the last three months. The secretion is derived from the decidua vera alone, or from it and the reflexa; and these may be the source, since (although they are generally blended) the division between them which exists during the first months, sometimes persists. If the fluid has a free exit into the cervical canal, the discharge may be more or less constant, although its quantity is small within any limited period; if however fluid cannot flow out continuously owing to the occlusion of the orifice leading into the cervical cavity, it accumulates between the decidua vera and ovum, gradually sinks and is then discharged at longer or shorter intervals all at once, in a gush; as a rule slight contractions of the uterus are connected with this, and this organ becomes distinctly smaller after the evacuation, although by degrees it again increases somewhat. I have in a good many cases seen a single copious discharge, but then it was always only a few (three at most) weeks or days before labour, and in every respect resembled the ordinary discharge of the liquor amnii; the uterus at the same time diminished considerably in size, the parturient canal became much softer and pains set in. Within a short time however (a few hours), and this feature clears up the diagnosis, the pains again subsided, and when labour came on subsequently, the fœtal membranes were found intact.

The discharge itself is thin, similar to liquor amnii both in colour and smell, and if it lasts for a considerable time is by that character distinguishable from one of cervical origin. No changes show themselves in the generative organs, if we except, what has been sometimes observed, great softening of the cervix and vagina. The patients are generally, but not always, multiparæ, frequently of a pallid aspect; if not already so previous to pregnancy, they may, when the discharge is copious, suffer in health, and get thin. Now and again a sanguineous discharge is associated with the thin serous one, a fact which is easily explained, if we remember the origin of both. It is not rare for the pregnancy to be interrupted before running its full time, on the one hand owing to the diseased condition of the inner surface of the uterus, on the other hand owing to the diminution of the pregnant organ which accompanies a sudden and copious discharge. Treatment can only be symptomatic. I recommend that digestion be kept in order, that the diet be strengthening, non-irritating and combined with iron; tepid baths once or twice weekly, a quiet mode of life, and morphia when there are contractions, will also be of use. I must caution against astringent vaginal injections or any other local treatment; they are useless, and cause an irritation which will be apt to provoke premature labour.

This hydrorrhœa must not be confused with the discharge of the fluid mentioned in § 91, which sometimes collects between amnion and chorion (amnio-chorionic fluid), and which may be evacuated previous to labour; but if so it is only once. The quantity of the chorionic fluid may be so great as to simulate hydramnion; M'Clintock relates such a case in his *Clinical Mem. on Diseases of Women*, 1863, p. 388. The discharge of the true liquor amnii is still less likely to cause confusion; for it is always soon followed by labour, and the bag of membranes is then found to have already burst. The numerous cases that are recorded of the so-called discharge of liquor amnii weeks before labour, are to be looked upon as cases of hydrorrhœa, in which the discharge only occurred once.

(3) *Leucorrhœa.*

§ 309. *Cervical leucorrhœa* depending on simple catarrh or on deeper seated inflammation of the cervix, and accompanied by erosion or even ulceration with the other sequelæ, is not rare in pregnant women; but in most of them it existed from before pregnancy, and is increased by the cervical changes associated with the latter. So long as the discharge does not weaken unduly, and the other local symptoms do not cause great discomfort, nothing should be done in the way of treatment beyond advising the cautious use of copious irrigations of tepid carbolic or salicylic acid lotions; if there is much irritation, merely of chamomile tea, and tepid hip-baths with a bath speculum. If however great weakness and discomfort are produced, I can after frequent trial recommend the single application of an active caustic (the red-hot iron is best), although I must strongly denounce repeated superficial cauterisations, especially by nitrate of silver; these are not unlikely to induce pains. The superficial abrasions and erosions of the edges of the os which are so frequently seen in pregnant women (*cf.* Lieven, *Würzb. Med. Zeitschrift*, v., 1864), are unimportant, so long as the surrounding mucous membrane is healthy, and no deeper disease is present; experiment has convinced me that they may be caused by digital examination, that a finger that is examining roughly may detach and scratch off the softened layer of epithelium. It is possible that coitus is also a cause.

§ 310. *Vaginal leucorrhœa* is commoner during, than apart from, pregnancy, owing to the predisposition caused by the physiological changes in the vagina (*cf.* § 71). The secretion may be very copious, sometimes thin and milky, sometimes like thick cream; a purulent or purulo-sanguineous discharge points to gonorrhœal infection. The hypertrophy of the papillæ, which has also been mentioned in § 71, may at the same time be very marked. Occasionally there is an abundant development of fungi, forming whitish or yellowish grey patches on a red ground, especially in the lower portion and at the entrance of the vagina. Owing to the copiousness of the secretion and to the accompanying irritation, which readily spreads to the vulva, and there often gives rise to an intolerable burning or itching (especially where fungi are developed), and owing to the urethra being also involved, the vaginal blenorrhœa may be very weakening and troublesome. Treatment must nevertheless be restricted to gentle remedies: attention to regular defæcation, scrupulous cleanliness, bidet hip-baths of tepid chamomile tea; cautiously performed irrigations with tepid lotio plumbi, dilute solutions of acetate of aluminium, carbolic or salicylic acid; at most the introduction every night of a small pledget of cotton wool soaked in glycerine and covered with small quantities of the remedies just mentioned, will suffice for diminishing the secretion and the symptoms, and often also lead to recovery. The vaginal walls become greatly hardened by the leucorrhœa, and when stretched during labour may be very painful, while the diminished elasticity may cause them to be torn; the skin of the perinæum also owing to the prolonged moistening with the irritating secretion, may sometimes grow very tight and rigid, so as to yield but little during the exit of the fœtus, and to tear easily. Sooner or later however recovery almost always takes place spontaneously, during the lying-in state, if not before.

The vaginal catarrh may lead to the formation of numerous little cysts lying closely together on the surface (*colpo-hyperplasia cystica* of Winckel), and which contain either fluid or merely air (*colpitis vesiculosa emphysematosa* of Ruge). They consist either of dilated lymphatics, or in rare instances of dilatations of the little glands which are now and again found scattered in some parts of the vagina; their usually multiple appearance points to the frequency of the first-named explanation. The air-vesicles generally contain atmospheric air, but sometimes a product of the small cysts (trimethylamin, according to Zweifel). After birth this condition generally disappears, without leaving any traces.

Pustular colpitis, although so rare even in the non-gravid condition, I have once seen during pregnancy. Dr. Matthews Duncan tells me of a similar case.

All these various conditions practically require the same treatment, as that already recommended for simple catarrh.

(4) *Abnormal Softening and Mobility of the Pelvic Articulations.*

§ 311. It was mentioned in § 72 that the swelling and abundant infiltration with intercellular fluid, which affect all the organs during pregnancy is also noticed in the fibrous les of the pelvic joints, and increases the synovial fluid. re cases however (in some mammalia, *e.g.* the guinea-pig, normal occurrence) this change takes place to an unusual e, and is associated with a painful condition of the affected , which is especially severe during movements of the trunk, uring progression; indeed the latter is rendered impossible. me cases it has been possible actually to demonstrate the mobility in the pelvic articulations; indeed even crepitation id to have been detected under such conditions. The n affected in this way must keep perfectly quiet, and wear ht pelvic bandage which will hold the articular surfaces her, and allow the latter the least possible range of move- . The same must be done after labour, if permanent and us mischief is to be prevented. Even inflammation of the c joints has been seen during pregnancy; the diagnosis and ment are given in text books of surgery, and require no al description.

e. Injury and Rupture.

312. The uterus may be *wounded* in the most various ways. e injury is slight, the gestation may go on, as has happened intended or unintended *tapping*, without harm to the er or even to the fœtus[1]. Instances of recovery after injury e uterus by a *gunshot wound* which involved the fœtus, are ded by Staples in the *New York Med. Record*, Sept. 9, 1876; Hays, *New Orleans Med. Surg. Journ.*, Oct., 1879, and rs. Very extensive injury, such as the slitting up of the us by the horn of a bull (Geissler in *Mon. f. Geb.*, xx., tcher), is usually fatal; such accidents must be treated rding to the rules for gastro-hysterotomy.

hen a uterus advanced in pregnancy is *ruptured*, without bdominal cavity being opened, the cause is often a crush; I know of a case in which a farmer's wife at the ninth month of pregnancy rolled with a cart down a steep incline. She at once showed signs of rupture, and was saved by gastrotomy. The symptoms of such an accident are those of the rupture of an extra-uterine fœtal sac at an advanced stage (*cf. infra*), and the only correct treatment is to remove the child by abdominal section.

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[1] andl (*l. c.*) relates such an instance of tapping, which occurred under Braun's ation. In my Maternity during the spring of 1879 a hydramniotic uterus was d, of course by mistake, without injury to mother or fœtus, the latter being born aneously a few weeks later. A similar result happened in the case recorded by er (*Lehrbuch d. Geburtsh.*), in which a meat hook had penetrated through the inal wall of a woman advanced in pregnancy, and entered the fœtal cavity.

Spontaneous rupture of the pregnant uterus is one of the rarest events; the instances in which it is said to have taken place during the first half of pregnancy are extremely doubtful in point of diagnosis; nor are all of those belonging to the later period quite clear, since they also may have been confused with extra-uterine fœtal sacs; some however cannot be so explained away. The rupture probably always depends on abnormal structure of the uterine wall (*e.g.* on a cicatrix left by previous Cæsarian section), on its destruction by some intra-parietal new growth or on degenerative processes; it then almost always takes place when the body is exposed to external violence, or when there is vigorous action of the abdominal muscles. These ruptures are comparatively often situated in the upper portion of the uterus, while those occurring during labour always affect the lower. An incomplete rupture has also been observed, *i.e.* a rupture of the uterine wall without its peritoneal lining being injured; a portion of the fœtus then lay in a closed cavity, which did not communicate with the peritoneal cavity (Hildebrandt, *Berliner Klin. Wochenschrift*, 1872, No. 36).

The signs of rupture are hæmorrhage, shock and alterations in the shape of the abdomen and uterus, *i.e.* in great measure those of the same accident in advanced extra-uterine pregnancy, or of rupture of the uterus during labour; the prognosis also is the same, and treatment will only offer much prospect of success, when the fœtus with its membranes is completely removed by gastrotomy. It is only in very exceptional cases that labour follows so rapidly after the accident, that the child can be born *per vias naturales*. (I heard of such a case at Freiburg in 1862 in the practice of the then assistant-physician Keppner in Hornberg [Baden]. In this case labour took place during the summer of 1861 on the fourth day after spontaneous rupture, and on the following [fifth] day was terminated by that practitioner after perforation of the dead child; the placenta was followed by a mass of coils of intestine, which were replaced and held back by a tampon. Recovery was rapid. In August 1862, Keppner after consultation with me induced premature labour at the 28th week in the same woman, who had soon again become pregnant; the child was born spontaneously and alive, but died after two hours, the mother passing through a perfectly normal post-partum period.)

Injuries of the *vagina* and of the *external generative organs* in pregnant women, apart from spontaneous rupture of a varix or a hæmatoma in those parts, must of course be due to external violence. The treatment to be adopted must depend on the principles of general surgery.

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4. *Diseases of the Ovum.*

This is not the place for a detailed description of the pathology of fœtal development. Consistent with the object of this book, we can only note those abnormalities which may disturb the progress of pregnancy or of labour.

a. Pregnancy outside the Uterine Cavity—Extra-uterine Pregnancy.

§ 313. The ovule is as a rule fecundated at the ovary itself or in the Fallopian tube near it, and passes from there to be imbedded in the uterine cavity. In rare cases however it imbeds itself in a portion of the genital canal on the proximal side of that cavity, namely in the Fallopian tube or ovary, or even in the serous membrane lying behind these organs; it then continues to develop in that situation, much as it would do in the uterus, and under favourable conditions reaches full maturity. Of the three principal varieties of extra-uterine pregnancy—*tubal*, *ovarian* and *abdominal*, the first is commonest, and the ovarian the rarest. Until recently, the occurrence of ovarian pregnancy was entirely denied; but its presence has now been definitely proved in at least 13 autopsies, while on the other hand no *a priori* objection to such an event can be raised. Since the cumulus proligerus of the ovum does not always lie in the follicle immediately behind the point of rupture of the latter, the ovule need not be discharged with the liquor folliculi, but may be retained in the discus proligerus; if then it is fecundated in that position (and we know that the spermatozoa penetrate as far as the ovary), it will find a soil in the theca folliculi, which possesses all the elements of a mucous membrane, and in which therefore the ovule may comfortably imbed itself. Such an event is less easy to understand in the case of a serous membrane, if the peritoneal sac is looked upon as a lymph-sac; but it will appear less strange if we remember that the ovum always imbeds itself in a part of the peritoneum in close proximity to the generative organs, and that this small portion of the peritoneum, even in the higher vertebrata, has a share in the sexual functions[1], that it is continuous with the germinal epithelium, and that an ovum lying on it will still be on congenial soil, and may there continue to live and develop for a time. Moreover islands of germinal epithelium sometimes occur at still more distant spots.

§ 314. The *causes* of tubal and abdominal pregnancy must lie in some *obstruction* which renders the passage of the ovum into and through the oviduct impossible or difficult, or else they must be looked for in the so-called *migration of the ovum*. All the other explanations (mechanical) have not a shadow of evidence to support them, and at post-mortems it is only now and then that even the obstruction above referred to can be demonstrated, since the extra-uterine development causes the most fundamental changes in the internal genitals, and obliterates primary anomalies. The obstruction in the tube may be complete or merely due to a lessened calibre, which allows the spermatozoa to reach to the ovule, but does not permit the latter, when fecundated and consequently increasing in size, to reach the uterine cavity. Where there is complete occlusion of one tube, the spermatozoon may pass through the other, which is patulous, and across the abdominal cavity to the adjacent ovary of the abnormal side, and there effect impregnation, after which the ovule is grasped and retained by the tube belonging to its ovary. The obstruction is generally produced by peritoneal adhesions and bands, which fix and bend the tube more than is usual; this view is in harmony with the fact that extra-uterine pregnancy in the majority of cases affects multiparæ, who have been more or less sterile for some years previously (for such anomalies are generally due to previous puerperal periods, and tend to make conception difficult), and also with the fact insisted upon by Hecker that left-sided tubal pregnancy is the most frequent (since pelvic inflammations are known to occur more often on the left than on the right side). In a few cases the obstruction to the passage of the ovum is said to have been caused by polypi blocking up the uterine end of the oviduct, as Breslau (*Monatsschrift f. Geb.*, xxi., *Suppl.* 1859), Beck (*Illustrirte Med. Zeitung*, ii., 1852), and Leopold (*Arch. f. Gyn*, xiii., p. 354) observed[1]; or by intra-parietal fibroids of the uterus (Magrath, *London Obst. Transact;* Roth in "Gross. tubaire," *Thèse de Strasburg*, 1844). Twins also have been somewhat often seen in tubal pregnancy, and it is not impossible that the two ova may have hindered each other during their transit. Nor must we forget the occasional presence in the Fallopian tubes of *accessory orifices*, as when the interstitial portion of the tube divides before entering the uterine wall (*cf.* Hennig, *l.c.*).

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[1] In the frog the endothelium of the abdominal cavity at the time of sexual maturity takes on a structure similar to the epithelium of the oviducts, and becomes ciliated.

The *migration of the ovum, i.e.* the *extra-uterine* m., is not a very rare event, and must be looked upon as one of the commonest causes of abdominal pregnancy. It may however also lead to the tubal variety, of course in the tube on the opposite side to that of the ovary which produced the ovum, as when an ovule fecundated in its ovary has during its journey attained to such a size that it can no longer pass through the tube of the opposite side as far as the uterine cavity. Moreover *intra-uterine* migrations, in which the ovum which had reached the uterine cavity in the usual way passes from there into the opposite oviduct and remains in it, an event the possibility of which was first suggested by Tyler Smith, have now been demonstrated by Schultze (*cf.* Hassfurther).

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[1] As regards the grounds for such an assumption, *cf.* Ahlfeld, *Centralblatt f. Gyn.*, 1879, Nos. 2 and 4. Leopold, *ibid.*, No. 3, takes the opposite view.

Amongst ætiological varieties must be ranked the cases of Lecluyse and Kœberlé. In the former (*Bulletin Acad. méd. Belg.*, 1869, iii., No. 4, p. 362), the abdominal pregnancy probably resulted from an opening several cm. in size, which remained in the uterine cicatrix of a previous Cæsarian section, by means of which opening the uterus and abdominal cavity communicated with each other. The latter case (Keller) occurred in a woman in whom Kœberlé extirpated the uterus and a part of the cervix about 2 years before, leaving the ovaries behind; the woman conceived through a fistula remaining in the cervix, and died in consequence of this pregnancy.

§ 315. The early development of the ovum, whatever be its extra-uterine point of attachment, is the same as in normal gestation; its appendages therefore, *i.e. chorion and amnion*, develop in the usual way. It is otherwise however with the membranes derived from the mother, *i.e.* decidua and sac; the formation of these will vary with the situation of the ovum, so that we have now to consider the several varieties of the abnormality. But first of all I must mention that the *formation of the extra-uterine placenta* will not present any special characters, since the decidua of the uterus itself is nothing more than connective tissue, and the chorionic villi are not in any essential, at most only in fortuitous, relation with the uterine glands, and are only connected with a relatively thin connective tissue layer of the serotina; indeed sometimes the villi are simply stretched out between the chorion and the decidua, the interspace between these amounting to no more than a cleft (Langhans). The extra-uterine placenta mainly differs from one of uterine origin, by the fœtal and maternal tissues being much more loosely connected with each other, although also by its situation, form and size; each of these characters is equally variable. Sometimes the placenta is very large and thick; sometimes large, but very thin and membranelike; sometimes it is extremely small. Occasionally it has been found broken up into a considerable number of small lobes with very ramifying blood-vessels, the latter penetrating into the most various abdominal organs.

Tubal Pregnancy.

§ 316. The ovum is sometimes attached to the abdominal extremity, sometimes to the uterine portion of the tube, sometimes to the portion that is perfectly free, *i.e.* more or less near its middle. Hence arises the division into tubo-abdominal, tubo-uterine and simple tubal pregnancy. At the seat of the attachment, a decidua and even a reflexa (Hennig) develop by outgrowths (in the form of villi and trabeculæ) from the vessels of the mucous membrane and of the subjacent connective tissue; the chorionic villi advance towards this connective tissue and sink into it, although the attachment is but loose. The formation of the placenta takes place much upon the plan in which it is met with in rabbits, cats and dogs; no reciprocal intergrowth of the chorionic villi and the maternal vessels seems to take place, nor does the maternal tissue penetrate into the fœtal placenta. The villi are merely stretched out between decidua and chorion, without being actually immersed in the maternal blood.

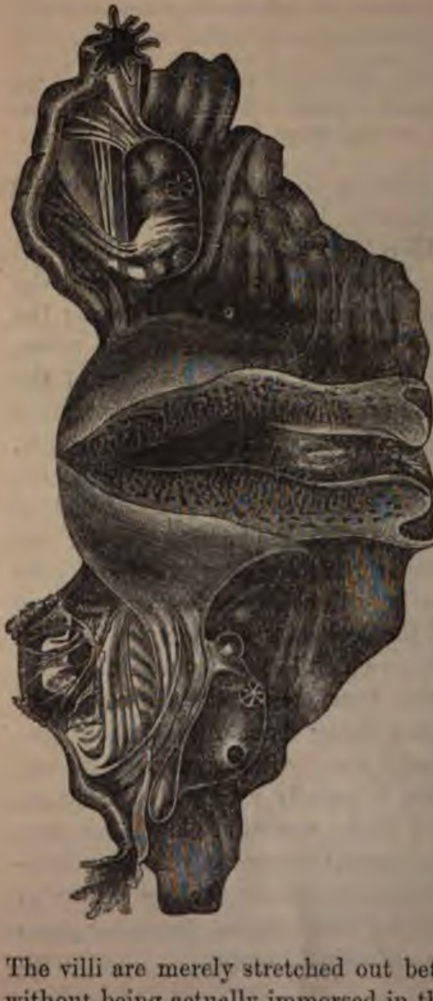

Fig. 64.—Tubal pregnancy of the left side. (Sommer, Greifswald, 1855.)

a. In simple *tubal pregnancy*, the fœtal sac is entirely formed by the walls of the Fallopian tube. These walls undergo hypertrophy as the ovum grows, although not to a corresponding extent; the wall of the Fallopian tube is gradually thinned, the muscular bands are separated from each other, the sac at last gives way under the pressure of the ovum and bursts (fig. 64). The rupture generally takes place at the free surface, *i.e.* the thinnest part of the sac, although it occasionally does so at the placental site; in the majority of cases rupture occurs within the first 8 weeks, but it is not infrequent in the third month; it is rare later on. There may be no premonitory symptoms of any importance, or partial tears may more than once precede the final one, and be accompanied by symptoms of local peritonitis. The fœtal membranes may give way, and the embryo escape into the abdominal cavity, or they may remain intact, and the ovum pass out entire; occasionally the latter remains altogether in the tube. When the fœtal sac is completely ruptured, fatal hæmorrhage generally ensues, but even in those cases in which the end is not so rapid, the secondary peritonitis as a rule causes death. It is possible even in these circumstances for recovery to take place, through the ruptured oviduct, or the embryo (which soon perishes), or the whole ovum being enclosed and shut off by masses of exudation; indeed this is doubtless the way in which the origin of many *retro-uterine* hæmatoceles is to be explained, viz. by previous rupture of a pregnant oviduct. The ovum, if young, perishes, shrinks up and is lost in the exudation; but if it is more advanced at the time of rupture, a new fœtal sac is sometimes produced by pseudo-membranes and adhesions, and the fœtus may undergo the changes which are shortly to be described under "Abdominal Pregnancy".

The hæmorrhage is always least, when the ovum remains sticking in the tube, since it may then act like a tampon in arresting the hæmorrhage at the point of rupture (Wiedersperg, *Prager Vierteljahresschrift*, 1865, iv.). These cases also are the most likely to recover, and Virchow was actually able to demonstrate such an event at a post-mortem (*Gesammte Abhandlungen*, p. 796). Sometimes the rupture is brought on by extravasation of blood into the placenta, and by the consequent stretching of the fœtal sac (*cf.* Kreuzer's case recorded by Kussmaul, *Von dem Mangel, der Verkümmerung und Verdoppelung der Gebärmutter, von der Nachempfängniss und der Ueberwanderung des*

Eies, p. 362, Würzburg, 1859); this occurrence probably always ends fatally, and is also met with in the other varieties of extra-uterine pregnancy.

The tube may rupture at its lower edge, which is not covered by peritoneum; in such a case the blood is effused into the tissues of the broad ligament and separates its two layers, the ovum making its way into the space between them. This doubtless very rare occurrence has been spoken of as *extra-peritoneal pregnancy* (Dezeiméris). It proves fatal through the effused blood breaking down the pelvic connective tissue &c.

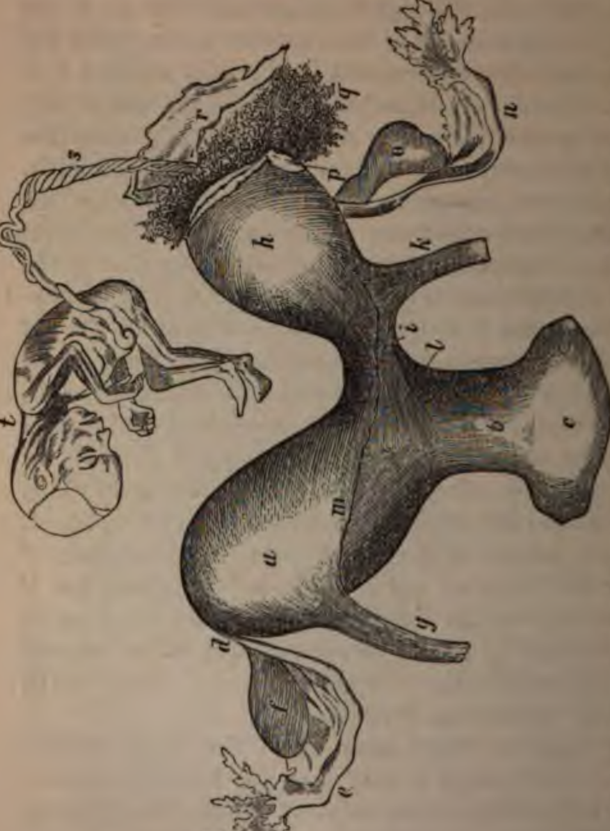

Fig. 65.—Pregnancy in a left rudimentary horn. (Kussmaul; observed by Heyfelder.)

a. Uterus unic. dext. *b.* its cervix. *c.* vagina. *d.* end of the right horn. *e.* right oviduct. *f.* right ovary. *g.* right round uterine ligament. *h.* rudimentary left horn, pregnant. *i.* connecting portion. *k.* left round uterine ligament. *l.* muscular fibres derived from the left round ligament and passing into the right horn, with the edge of the dissected peritoneal lining. *n.* left oviduct. *o.* left ovary with corp. lut. *p.* point of rupture with everted edges. [illegible] membranes. *s.* umbilical cord. *t.* embryo.

In exceptional cases, tubal pregnancy reaches the *full term*. This of course can only be explained by an unusual hypertrophy of the muscular tissue of the tube, which enables it to resist the stretching; still there are several examples of the tube being sufficiently stretched to harbour a five months, and even an older, fœtus[1]. Saxtorph has recorded (although it is not very accurately described) a case of tubal pregnancy in which the fœtus was *mature*, and I have been able to add a similar observation, in which there could be no possible doubt (*Arch. f. Gyn.*, i., p. 406); Fabbri also (*Mem. dell' Acad. dell' Instit. di Bologna*, 1871, xii.) has seen a tubal pregnancy advance to the 9th month, and then after the death of the fœtus run on to the twelfth; two additional cases are related by Simpson and Tinker (*cf.* under Fränkel), and a sixth by Litzmann (*Arch. f. Gyn.*, xvi., p. 323).

But the most favourable termination of a tubal, as of every other extra-uterine, pregnancy is the very early death of the ovum, before rupture takes place; for then nothing is left except the remains of a hæmatoma. Doubtless this event is not so rare as is generally supposed, and these cases probably constitute a by no means small proportion of those described as hæmatomata of the pelvis, or hæmatoceles.

§ 317. *Pregnancy in a rudimentary uterine horn* (fig. 65) runs a course extremely like that of tubal pregnancy (*cf. supra* § 272). Hitherto 20 such cases have been observed (*cf.* Jänsch, Virchow's *Archiv.*, vol. 58); in almost every one (in 16 out of 18 of which there is a record) rapid death took place by rupture of the horn and by hæmorrhage; although somewhat later than happens on an average in simple tubal pregnancy, viz. between the 3rd and 6th months. The rupture invariably occurred at the apex of the horn, in the neighbourhood of and above the point of insertion of the oviduct; indeed this is always the thinnest portion of the walls of the horn. In one case the fœtus died in the horn at the 5th month, and was converted into a lithopædion; in another the normal termination of pregnancy was reached (Turner), and the child, when the pains after lasting for several days had ceased, became changed into a lithopædion and was extracted from the mother, on her death six months afterwards from phthisis[2]. The course and termination of pregnancy in a uterine horn are so similar to those of tubal pregnancy, that it will probably never be possible to diagnose one from the other during life; at best may we have reason for suspecting a pregnant horn, if, as just mentioned, the rupture takes place at a somewhat late date. Should the case

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[1] They are recorded by E. Fränkel (*Arch. f. Gyn.*, xiv., p. 205).

[2] A case in which a lithopædion was formed after bursting of the horn, is related by Chiari. (*Wiener Med. Wochenschrift*, 1876, 24 Nov.)

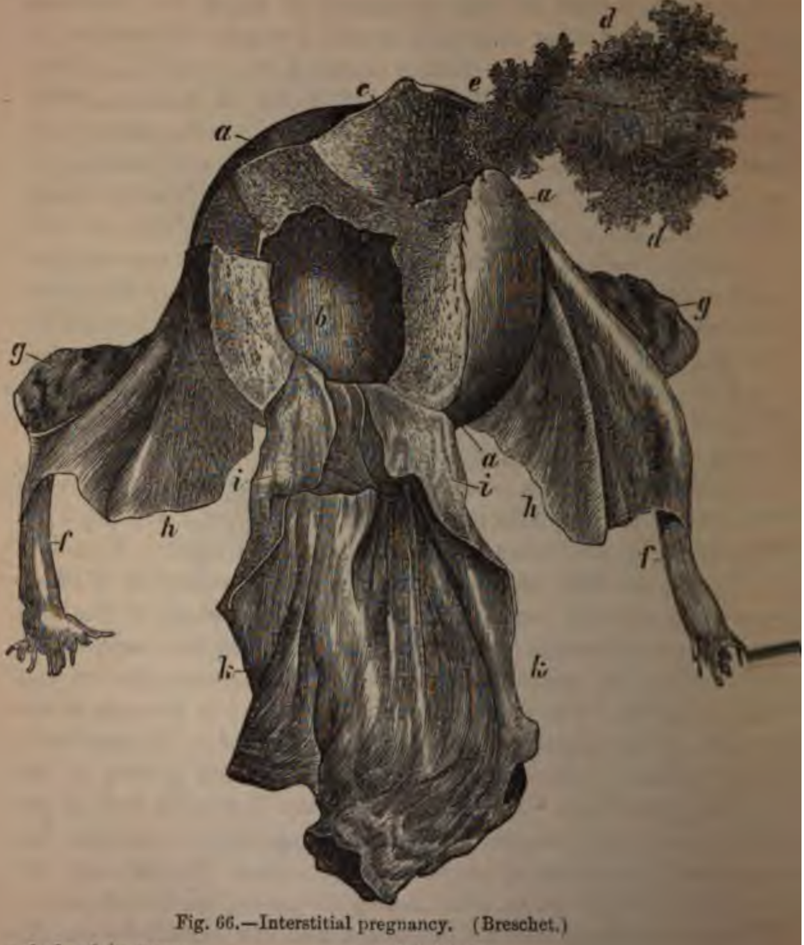

Fig. 66.—Interstitial pregnancy. (Breschet.)

a. body of the uterus.
b. its cavity opened from the front.
c. fœtal sac in the uterine wall.
d. ovum with hypertrophied villi.
e. point of attachment of the placenta, which still adheres to the uterine wall.
f. oviduct.
g. ovaries.
h. peritoneal folds of the broad ligaments.
i. cervix } opened.
k. vagina } opened.

be one in which a lithopædion is formed, the thought of abdominal pregnancy will always be uppermost, as it will also be with a similar termination of a tubal pregnancy. Even *post mortem*, the diagnosis from a tubal pregnancy is not easy, and these cases used invariably to be mistaken for the latter; the origin of the round ligament is the best guide, for, while in tubal pregnancy that origin is placed on the uterine side of the fœtal sac between it and the uterus, in pregnancy in one horn the ligament starts from the outer side of the sac.

§ 318. *b. Tubo-uterine* or *interstitial pregnancy* arises, as already remarked, by the ovum becoming attached to, and developing in, the portion of the tube which pierces the uterine wall (figs. 66 and 67). This portion first undergoes eccentric hypertrophy, and forms a small bulging sac at the upper corner of the uterus; but before long the walls of the sac no longer grow *pari passu* with the ovum, and the sac bursts at its outer side as in ordinary tubal pregnancy. This rupture usually occurs within the first three months; only in rare cases do the adjacent uterine tissues hypertrophy to an enormous extent, and form a

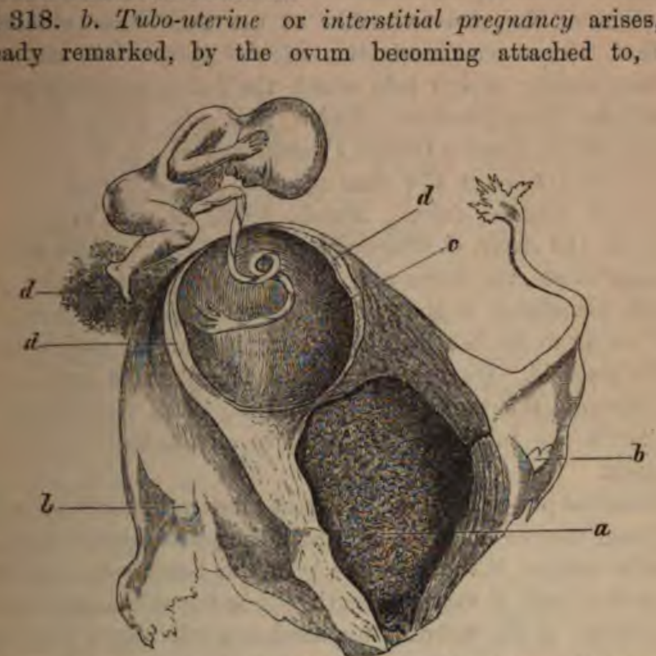

Fig. 67.—*a.* uterine cavity. *b.* round ligaments. *c.* fœtal cavity. *d.* placenta. (Poppel, *Monatsschrift f. Geb.*, xxxi.)

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firm capsule round the ovum (much as happens with an intra-parietal myoma) so that the latter can resist the pressure, and the fœtus attain maturity. In a woman under the care of Rokitansky (*Handbuch*, iii., p. 608), pregnancy lasted 16 months, and the fœtus, which was over-mature and had been dead for a considerable time, was extracted by laparotomy. The fœtal sac in interstitial pregnancy scarcely ever communicates with the cavity of the uterus or Fallopian tube, the openings originally leading to it being obliterated. Only in a few cases has a dilatation of the uterine orifice of the tube been observed, together with a communication of the epi-uterine sac with the free uterine cavity, into which the fœtus projected partly or entirely (Monteils-Pons, *Union Médicale*, 1856, No. 51; Braxton Hicks, *London Obstet. Transactions*, ix., p. 57; possibly to this class belongs the case recorded by M'Burney in the *New York Medical Journ.*, March, 1878, as well as that by Mundé in the *Amer. J. Obstetrics*, xii., p. 330). Where such a condition exists, the fœtus may be born *per vias naturales*, the placenta remaining in the epi-uterine sac; but rupture of the latter owing to its thin layer separating it from the peritoneum, is also possible. On the other hand the placenta may alone grow towards the uterine cavity and be born, the fœtus remaining in the tubal cavity, subject to all the sequelæ of this condition.

Interstitial pregnancy may at a post-mortem be confused with a pregnant uterine horn, since in both the round ligament bears a similar relation to the fœtal sac. In the latter case however, a muscular band of varying length will be found connecting the two portions of the uterus; this band as a rule comes into connection with the pregnant horn not in its upper portion but lower down, just above the situation of the internal os. In interstitial pregnancy, on the other hand, there is at most a more or less thick partition wall between fœtal sac and uterus, the former being attached to the latter by a broad base. In interstitial pregnancy, as the growing fœtus rises up, the whole uterus will be drawn up with it, as occurs with intra-parietal swellings placed at the fundus; with a pregnant horn on the contrary, this does not occur, or at any rate does so in a less marked degree. Finally, the decidua formed in the rudimentary horn will probably be better developed than it can be on the mucous membrane of the tube which lines the sac in interstitial pregnancy—evidence enough to decide a doubtful case.

§ 319. In *tubo-abdominal pregnancy* (also called *tubo-ovarian*, inasmuch as the ovary may quite early be involved in the formation of the fœtal sac), the ovum attaches itself to the abdominal orifice of the oviduct, and develops there. Since the tube in these cases only constitutes a portion of the sac, the remainder being furnished by the surrounding serosa, this form of extra-uterine gestation may be described with the abdominal variety.

Ovarian Pregnancy.

§ 320. This variety, as mentioned at the beginning, only occurs, when an ovule is impregnated in its follicle and becomes imbedded in it; when the latter process takes place after the ovum has passed out on to the surface of the organ (epi-ovarian pregnancy), the case is one of abdominal pregnancy. The fœtal sac may be formed by the wall of the follicle and the neighbouring ovarian stroma, and by its rapid growth envelop the growing ovum on all sides, so that the latter comes to lie entirely beneath the albuginea, the sac resembling an ovarian cyst; or else at the point where the follicle ruptured, there remains an aperture through which the ovum grows out, and thus comes to lie as in abdominal pregnancy, while the placenta remains in the ovary. Both conditions have been observed. The following characters however show that the gestation is of ovarian nature: 1. the absence of the ovary in question; 2. the presence of well marked ovarian structures in the wall of the fœtal sac; 3. a connection of the latter with the uterus by means of the ovarian ligament; and 4. the fact that the oviduct has no share in forming the fœtal sac, while the topographical relation of the tube is the same as, or similar to, that met with in ovarian cystomata.[1]

But whichever be the mode of further development of the ovarian pregnancy, in both cases the sac usually ruptures by the 3rd or 4th month. If the sac is formed in the manner first described, the hypertrophy of the ovarian tissue will rarely keep pace with the degree to which it is stretched; nor is the comparison which has been drawn between it and a rapidly growing cystoma to the point, since the latter grows in consequence of some morbid new formation and not by mere increase in size, and since the ovarian tissue need not be stretched in any way. When on the other hand the fœtal sac gains additional strength by involving neighbouring parts of the serosa and the organs lined by it, an ovarian, like an abdominal pregnancy, may approach to, or even attain, the full term; the progress of the ovarian is then practically the same as that of an abdominal pregnancy.

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[1] I have shown elsewhere (*Arch. f. Gyn.*, xiii., p. 73) that only nine of the cases so far recorded in medical literature, satisfied these conditions. The example which I have published forms the tenth. Since then one has been described by Hildreck (*Boston Med. Surg. Journ.*, Nov. 8, 1877), one by Patenko (*Arch. f. Gyn.*, xiv., p. 156), and one by Benicke (*Zeitschrift f. Geb. u. Gyn.*, iv., p. 276), making 13 reliable cases, to which should probably be added as a 14th the preparation discovered by Bandl (*Handbuch der Frauenkrankheiten* by Billroth, Part v., p. 49) in the Pathological Museum at Vienna.

Peritoneal or Abdominal Pregnancy.

§ 321. We spoke in § 313 of the way in which this variety originates. The ovule, attached to the germinal epithelium, is nourished through a reciprocal approximation of the chorionic villi and of the new tissue which springs up from the serosa, and (as is seen in the case of other organised bodies which have passed into the peritoneal cavity under yet more unfavourable circumstances) is at last enveloped by a capsule produced by the neoplastic structures. This capsule may grow *pari passu* with the ovum, during which time (through the serous membrane and through organs lined by the latter, and situated further and further from the primary seat of attachment, contributing to the formation of membranes) it grows stronger, becomes adherent to neighbouring organs, and thus forms a strong fœtal sac which is closed on all sides. Or else the primary capsule atrophies or tears, as the ovum continues to grow, so that the latter at last lies free in the abdominal cavity, merely attached to the serosa by the placenta[1]; the former event is the commonest. It is worthy of notice that as a rule the newly formed fœtal sac contains muscle cells, doubtless derived from the musculature of the subserosa of the pelvis, their presence being distinctly shown by the part they afterwards play in the efforts at expulsion. It is in this kind of pregnancy that the placenta presents the greatest divergencies from the uterine organ, both in form and size, and these characters moreover vary greatly in different cases; on an average the placenta is much more bulky, when situated on the pelvic peritoneum than when higher up, the former (the germinal epithelium) too is the usual seat of insertion, although placentæ have been met with on other viscera, and even on the anterior abdominal wall (Kœberlé).

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[1] *Cf.* the above-mentioned case of Lecluyse, that of Matecki (*Monatsschrift f. Geb.* xxxi.), and that of Jessop (*London Obstet. Transactions*, xviii., p. 261).

§ 322. By *secondary* abdominal pregnancy, are meant those cases where the fœtus, after lying primarily in the tube, the ovary or even in the uterus, continues after the rupture of such organ to grow in the abdominal cavity, and in which, while the ovum remains connected with its first sac, the latter is enlarged and strengthened by the adhesion of the abdominal viscera, and by the formation of pseudo-membranes. It is rare for an ovum which has passed *entirely* out of the primary sac, *i.e.* together with its placenta, to survive the dangerous conditions which are then set up, and for it to create fresh connections and a fresh sac; such however does take place, and fœtuses have been found years afterwards still connected with maternal organs, and fairly well preserved. It is however not proved as has been supposed (Braxton Hicks, *London Obst. Transactions*, vii., p. 101), indeed it is in itself improbable, that the ovum which has passed quite early out of the ovary or the tube in an intact condition, can form new connections and a placenta with the help of the peritoneum; this would in the strict sense be a secondary peritoneal pregnancy.

§ 323. Abdominal pregnancy reaches the full term more often than any other abnormal variety, and as a rule is attended with the minimum of discomfort, so that it is not uncommonly only discovered when the pains set in, or still later. There may however during the later months be severe attacks of pain of an extremely agonising and exhausting character; they seem especially to occur in the case of ova lying free in the abdominal cavity, and to be caused by the fœtal movements. In other cases pressure on the pelvic organs or attacks of peritonitis disturb the course of pregnancy, and weaken the woman. Moreover rupture of the fœtal sac may take place before maturity is reached, and is generally due to some external influence; or blood may be effused into the placenta, leading to hæmorrhage into the sac, to death of the fœtus and to secondary rupture of the former; under such circumstances the hæmorrhage or the secondary peritonitis is generally fatal, although it is commoner in these cases than with tubal pregnancy for the patient to survive the risks, and to be endangered by the changes that subsequently take place in the fœtus.

Sequelæ and Complications.

§ 324. If everything goes on well till the fœtus attains maturity, efforts of expulsion set in at the usual time; the uterus, the fœtal sac, and the voluntary muscles come into action. The former opens up and expels the superficial layer of the decidua, the detachment of which, as is shown in an accurate observation of Hélie (*Monit. des Hôpitaux*, 1860) begins at the internal os. These attempts at parturition, in which the breasts frequently participate, possess a certain amount of physiological interest, as showing that the stimulus to labour at the full time does not lie in the uterus, but rather in the fœtus and the great nervous centres (*cf.* § 141). During the efforts at expulsion, the fœtal sac may burst (Thormann,—*Wiener Med. Wochenschrift*, 1853—saw a case in which the sac which had been pushed forwards into Douglas' space, made its way through a rent in the posterior vaginal wall, where an arm of the child appeared), or rupture may take place by detachment of the placenta, hæmorrhage into the sac, and by consequent excessive distention of the latter; the patient will rarely survive the consequences of such an event, but succumb to shock, internal hæmorrhage or peritonitis. As a rule however the sac does not give way, and in this case, if the fœtus has not been previously excised, a quiescent condition returns after a few days, possibly again to be interrupted by the onset of pains. The child usually dies, although in a few rare instances it has survived the normal time by some days and weeks (*cf.* Keller, *Des grossesses extra-utér.* &c. Paris, 1872, p. 40. Most of the older cases of prolonged pregnancy belong to this class). The abdomen diminishes somewhat in size, probably owing to absorption of the fœtal fluids and to collapse of the placenta; the uterus becomes involuted, while the lochial discharges begin. The woman suffers more or less, for the fœtus cannot remain in its sac without undergoing changes.

§ 325. In the majority of cases, the fœtus soon decomposes and becomes macerated in the effused blood and in its own and the surrounding fluids. The irritation thus produced provokes inflammation and suppuration in the fœtal sac, which proves fatal through septicæmia and through extension to the neighbouring peritoneum. If however the inflammation and suppuration are confined to the fœtal sac, if the whole process takes place somewhat slowly, so that the patient has strength to resist the septic infection &c., the sac behaves like a large intra-abdominal purulent exudation, and may, as is not very rare, discharge its contents externally. Perforation affects (in order of frequency) the intestine (colon and rectum), anterior abdominal wall, vagina or bladder (strangely enough described as vaginal and vesical gestation), and sometimes takes place by several openings at once. The fœtus is either expelled suddenly and *en masse* (*e.g.* through the anterior abdominal wall—Kiwisch; through the rectum—Grenser, Schmidt's *Encyclopedia*, Supplement, iii., 1845, and Duncan, *Edinburgh Med. Journal*, July, 1863), or piecemeal. In the latter case the process may last for years, and may at any moment prove fatal to the woman through the prolonged suppuration, recurrent attacks of peritonitis, or a closure of existing fistulæ and the development of fresh ones; but not a few observations are on record, in which, especially with subsequent surgical assistance, the suppurating mass has been completely got rid of, being followed by cicatrisation and recovery with or without persistent abnormal fistulous passages. The exit through the abdominal walls yields the best results; that through the intestine the worst, probably because it is least easy to give any assistance.

§ 326. The most favourable change in the extra-uterine sac is the rare occurrence of the production of a so-called *lithopædion*. Here the rapid disintegration of the fœtus and the inflammation of its sac do not set in after its death, but the fluids in the sac are absorbed, its walls collapse on one another and on the fœtus. The skin of the fœtus, and afterwards the soft parts beneath the skin as well as those further from the surface, are converted into fat (adipocere) and into a greasy pulp (consisting of fluid and crystalline fat, cholesterin crystals, and yellow pigments derived from the blood); in this way the bones are loosened from their connections and the whole mass is infiltrated with lime-salts, the fœtal surface becoming incrustated with them. Sometimes the whole of the fluid contents disappear by absorption and inspissation, and the incrustation advances to such an extent that nothing remains but the bones, and a heap of calcareous plates; even the sac is calcified into a shell. At other times the fœtus merely shrivels to a mummylike mass through the formation of adipocere, a deposition of fat and incrustations on its surface, while it retains its shape and position; the organs and even their most minute elements may be preserved for an extraordinary time in their dried condition. The lithopædion may lie for many years imbedded in dense masses of connective tissue without injury to the patient (Chiari, *Wiener Med. Wochenschrift*, speaks of a lithopædion that was retained for 49 years); the latter may meanwhile become pregnant and pass through the whole puerperium unharmed[1], or there may be merely some mechanical obstruction to labour, if the tumour lies in the pelvic cavity. Sometimes however, and this is favoured by a fresh pregnancy and labour, the lithopædion sooner or later undergoes decomposition; suppuration takes place in it and its vicinity; and although by means of perforation and by a complete or partial evacuation of the lithopædion, recovery is still possible, an unfavourable issue is by no means improbable.

§ 327. In very rare cases extra-uterine gestation takes place *inside a hernial sac* (inguinal or crural). It is possible that in the majority of the few cases that have been made known (Parry, tells of six, *cf.* Literature), this abnormality was confused with a pregnant uterus lying in a hernia, but in that published by Widerstein-Genth (*Verhandlungen d. Geb. Gesellschaft*, Berlin, vol. 8, 1855, p. 97), in which there was a previously existing inguinal hernia of the ovary, an extra-uterine and at the same time an extra-abdominal pregnancy undoubtedly existed; the fœtus at four months was removed by herniotomy, and the mother recovered.

Rokitansky has, under the names of secondary *cervical and vaginal pregnancy*, described conditions associated with abortion, in which an ovum, which had been expelled from the uterus and still remained suspended by a pedicle of decidua, continued for a while to hang in the cervix before being entirely expelled.

§ 328. Amongst other complications of extra-uterine pregnancy must be mentioned the development of *twins* in the same fœtal sac, *molar degeneration* (Otto, "Ueber Tubenschwangerschaft, &c.," *Dissertation*, Greifswald, 1871), the *recurrence of extra-uterine gestation* after recovery from a previous one (as an illustration of this, Haydon has recorded an instance of tubal gestation in the *Lond. Obstetrical Trans.*, v., p. 280; and Puech, *Gazette Obstétricale*, 1879, No. 21, has collected eight cases out of 180 of extra-uterine pregnancy scattered about in medical literature), and lastly the *simultaneous existence of intra- and of extra-uterine pregnancy* resulting from one conception, or from two such near to each other. (We have already spoken of uterine pregnancy taking place where one fœtus was already incapsuled.)

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[1] *Cf.* the observations by Anderson (*Centralblatt f. Gyn.*, 1878, p. 188), Kjönig (*ibid.*, 1879, p. 286), and Dahlmann (*Arch. f. Gyn*, xv., p. 128). I also have seen such a case; *cf.* my *Clinical Notes*, 1869—70, No. 264—delivery was spontaneous.

Quite a number of the last-mentioned cases have been observed. The extra-uterine sac may rupture during the progress of the pregnancy, and the case terminate in one of the ways already referred to; or the uterus may abort, and the extra-uterine fœtus continue to develop (*cf.* Argles, *Lancet*, Sept. 16, 1871; Beach, *Journ. of the Gyn. Soc. of Boston*, v., 1871, p. 103); or else both fœtuses may live side by side till the normal time of labour, and cause so little disturbance that the complication is only recognised during delivery. The abnormal fœtal sac may then rupture, or may make delivery of the intra-uterine fœtus more or less difficult, or even impossible *per vias naturales*; or else the intra-uterine fœtus is born, while the other remains behind. The fœtal sac suppurates &c. (Chabert, *Arch. Tocolog.*, iii., p. 673), or a lithopædion is formed (Cooke, *Lond. Obst. Transactions*, v., p. 143; Greenhalgh, *St. Bartholomew's Hospital Reports*, 1865; Pennefather, *Lancet*, No. 25, 1863; Pellischek, *Oesterr. Zeitschrift f. Prakt. Heilkunde*, No. 27, 1865). In a few cases the extra-uterine fœtus has been removed by gastrotomy, and Rosshirt has extracted it by an incision into the vagina (*Lehrbuch d. Geburtshülfe*, p. 444). If the complication is recognised in time, in the way which I will immediately indicate, an attempt should first of all be made to keep the parturient canal clear for the intra-uterine child; if however this cannot be done, or if all the circumstances of the case point to an unfavourable prognosis under expectant treatment, the extra-uterine fœtus should be removed by gastrotomy, and the intra-uterine should only be interfered with, if such a step appears absolutely necessary. It can scarcely be advisable where labour is obstructed, to diminish the intra-uterine fœtus with the object of preserving the extra-uterine sac and its contents, considering what a slight prospect there is of the child being saved, and of the mother recovering.

Signs and Symptoms.

§ 329. The signs and symptoms associated with extra-uterine pregnancy, are partly those usually met with in pregnancy, and partly the result of the abnormal development and of the local disorders which it causes; they will therefore in part be physiological, in part pathological. The former, especially as far as the general symptoms are concerned, may be present exactly as in uterine pregnancy, and generally are so. *Menstruation* almost always ceases (the contrary statements arise from pathological hæmorrhage having been mistaken for menstruation), and usually only reappears after the death of the fœtus, in case the mother survives the latter; where the fœtus reaches maturity, it ceases for the same period as in normal pregnancy. But irregular losses of blood, and sero-sanguineous discharges, especially during the first months, are by no means uncommon, and are due to the presence of a decidua in the uterus.

The *uterus* undergoes hypertrophy, its cervix changes in the usual way, and its mucous membrane gives rise to a *decidua;* the latter however presents a difference in that it does not advance beyond the stage of development to which the vera attains at the third month in an ordinary pregnancy, and in that from this time onwards the relative positions of the glands and of the interglandular tissue undergo no further alteration; moreover the separate layers of the decidua are not always so well differentiated, nor does the glandular epithelium undergo so extensive a destruction (Kundrat, Stricker's *Med. Jahrbuch*, 1873, p. 175). The *increase in size* too of the uterus is soon arrested, indeed after the fourth month some involution may take place; the increase is more marked in tubal than in abdominal pregnancy, and generally speaking seems to be greater, the more closely the fœtal sac is connected with the uterus. The *uterine souffle* is sometimes distinctly audible, and may originate in the uterus or even in the fœtal sac (Cazeaux; Kennedy, *British Medical*

Journal, 1869; Kœberlé). The *shape* of the uterus does not differ from that of a non-gravid, but merely hypertrophied organ. Its *position* varies according to the situation in which the ovum develops. If the latter lies in Douglas' space, the uterus is pushed forwards and upwards, usually also somewhat to one side, since the ovum is rarely placed exactly median. As the ovum rises up, the uterus is again pushed down; or when the ovum develops primarily at a point lying above Douglas' pouch, it may from the very first lie below, in front of, behind, or to one side of, the fœtal sac.

What has been said of the changes in the uterus, is true to a certain extent of those in the vagina, external generative organs and breasts. If the pregnancy does not end before the period at which the manifestations of fœtal life can be made out, the heart-beat and movements of the fœtus are distinctly perceptible, sometimes even earlier than when the ovum is placed normally, owing to its greater accessibility.

§ 330. Morbid symptoms are not always present; indeed the pregnancy may reach the full term without any symptoms whatever. Scanzoni relates a case in which a woman with a nine months' extra-uterine fœtus was discharged from a lying-in hospital, through being considered not pregnant; in the case of tubal pregnancy with a mature child which I have published (*Arch. f. Gyn.*, i., p. 406), no symptoms appeared till the end of pregnancy, *i.e.* till labour. As a rule however disorders set in from the very beginning, caused by the inflammatory processes in the vicinity of the sac, and by the pressure &c. of the growing ovum. This is the explanation of the pains in the pelvis and hypogastrium (especially at the sides), sometimes of a dull fixed character, sometimes occurring at intervals, and then indicative of fresh attacks of inflammation; the latter may in a short time greatly reduce the patient. The attacks are not rarely accompanied by uterine hæmorrhage, and by the discharge of shreds of decidua; when this is the case, especially if the attacks have the character of "pains", they are frequently the precursor of a fatal issue through rupture of the fœtal sac. The seat of the pain corresponds to the formation of a tumour, which is generally intimately connected with the uterus. Thus very often the whole course of events forms a typical picture of a subacute pelvic inflammation or pelvic peritonitis. Under these circumstances a healthy and quiescent state may to a certain extent and gradually return, and the pregnancy continue its course, as already described in regard to the abdominal variety; or else the critical event, sc. rupture of the fœtal sac, takes place, sometimes unexpectedly, sometimes in the midst of the symptoms mentioned. It is especially apt to occur at the period at which the catamenia would return if pregnancy did not exist, and is accompanied by signs of collapse and of internal hæmorrhage (*cf.* § 316).

Diagnosis.

§ 331. A diagnosis is all but impossible during the first 3 or 4 months, and can only be arrived at in exceptional cases. This is due on the one hand to the fact that the recognition of the gravid state during this period is always connected with great difficulties; on the other hand to the fact that when the symptoms do more or less compel the supposition of pregnancy, it is impossible absolutely to exclude uterine gestation, since even where the embryo is not in the uterus, the latter and the other portions of the generative system which are accessible to exploration, present the changes which belong to the first months, and since lastly both the subjective and the objective symptoms caused by the formation of the fœtal sac, will admit of another interpretation. If however the existence of pregnancy is extremely probable, a *repeated* proof that the uterine cavity is empty, as shown by the sound, may be indicative that the fœtus is elsewhere than *in utero;* but it must not be forgotten that such a method of procedure is not admissible, unless the supposition of the ovum being in the uterus can be entirely set aside; and it must further be borne in mind that the possibility of passing the sound more or less deeply into the uterus does not allow of an absolutely final conclusion, inasmuch as the sound will sometimes penetrate easily into the pregnant organ, and if only introduced once or twice, need not necessarily do damage. Generally speaking therefore, the diagnosis during the earlier period can at most be a matter of probability; and the most valuable signs, apart from the indications of pregnancy in the genital tract, are the position and shape of the suspicious tumour, the pain or attacks of pain which do not coincide with the supposition of ordinary pregnancy, the sanguineous discharge from the uterus, the expulsion of portions of decidua, as well as the whole progress of events. But it must not be forgotten that encysted exudations and extravasations (hæmatomata) may under such circumstances give rise to exactly similar symptoms; puncture of the tumour may then supply negative or positive information by yielding liquor amnii, and such a proceeding is all the more to be recommended inasmuch as it has a curative action. If the patient is only seen after rupture has occurred, the symptoms associated with this accident, and the history of the case will throw light on its nature, although even then certainty is as a rule only obtained at the autopsy.

§ 332. The more the fœtal sac continues to grow, the more easily and distinctly its contents become accessible to examination, and the more it becomes separated from the uterus, the easier will be the diagnosis. If the fœtus is recognised, the only further point is to establish the fact that it is not in the uterus, and this can sometimes be done by trying to isolate the latter from the fœtal sac, by making sure that it is empty (with the help of the sound), and by showing that it is much too small in proportion to the fœtus, while the walls of the fœtal sac are much too thin to be those of the uterus. As a rule however it is just this distinction of the uterus from the fœtal sac by palpation that is so difficult owing to the very intimate and extensive connections that generally exist between the two, so that doubt may be felt even till the time of the labour pains; when the latter commence, the dilatation &c. of the cervix, which is not in the usual proportion to the pains, and the discharge of bits of decidua would be a guide. The greatest difficulties are met with, when the presence of the fœtus cannot be distinctly made out, either because it is dead, and the fœtal sac is difficult to palpate, or because much liquor amnii is present (Depaul has actually met with hydramnios in extra-uterine pregnancy). At such times confusion with ovarian cysts or with fibro-cystic tumours of the uterus is very apt to occur. The surest guide is furnished by the discovery of uterine changes due to the pregnant or puerperal condition. An exploratory puncture will give complete information, and it is entirely justified, since in case of necessity, *i.e.* if the case be one of extra-uterine pregnancy, gastrotomy may follow it at once; indeed under some circumstances an exploratory incision would be justified.

It is almost impossible to distinguish the various kinds of extra-uterine pregnancy during the first months, although a lateral tumour might suggest a tubal or ovarian, a retro-uterine tumour an abdominal pregnancy. If the pregnancy lasts more than four months, the case is almost certain to be one of abdominal or ovarian pregnancy.

The diagnosis of the further issues, of rupture, suppuration, or the formation of a lithopædion, must be made from the symptoms that have been described.

Prognosis.

§ 333. It will be gathered from what has been said above, that the prognosis is highly unfavourable both to mother and fœtus. The latter is almost always lost, for even at the present time the cases in which it has been saved by excision are very rare. The mother usually dies, if we again sum up what has been mentioned above, from rupture of the sac and hæmorrhage, from subsequent peritonitis, or from the septicæmia and exhaustion due to the suppuration of the fœtal sac. Recovery may however take place, if the abscess cavities are emptied, and if the fœtus is discharged or converted into a lithopædion; but a fœtus that has become incapsuled and petrified may at any future time prove a source of fresh danger.

Ovarian, and especially abdominal, pregnancies are the most favourable. While out of 100 cases of mixed extra-uterine pregnancy, Kiwisch only saw recovery in 18, out of 132 cases of abdominal pregnancy collected by Hecker, 76 (57·5 per cent.) terminated favourably. According to Puech (Courty, *Maladies de l'Utérus*, 1866, pp. 994—96), out of 100 cases of tubal pregnancy rupture took place 98 times and death 97 times; and in addition one case of death occurred through rupture of a vein of the broad ligament, and one through an accidental cause; out of 199 cases where the fœtus was expelled or gastrotomy performed, *i.e.* in the ovarian or abdominal variety, recovery took place in 146 (73·3 per cent.). But these statistics are undoubtedly too favourable, for it is well known how much more often successful than unsuccessful cases are published.

Treatment.

§ 334. The treatment of extra-uterine pregnancy will vary reatly, according to the period at which the patient is first een.

a. During the first 3 months, in which the diagnosis can only e made with more or less probability, nothing can be done xcept to treat the numerous disorders symptomatically. If it ecomes more and more clear, both by the symptoms and the hysical signs, that the ovum is not normally situated, it will e best to assume that it is extra-uterine, and by *puncturing the ac* to destroy the vitality of the ovum, *i.e.* to kill the embryo, nd to bring about its atrophy. This may be done with less esitation, since puncturing is permissible and indicated in hose other conditions which might possibly be present (cystic ew formations, encysted hæmatomata and exudations); and lthough we shall but rarely actually puncture a fœtal sac and hus save the life of the mother, these rare cases would be a istinct gain. The puncture must be made at the most tense nd accessible part of the sac, either *per vaginam* or *per rectum*, nd with a so-called exploring trocar; if little runs out of the anula, the help of the aspirator may be called in, although it is pt to induce intra-cystic hæmorrhage. Puncturing was recomnended by Basedow and Kiwisch, and has been successfully arried out by Martin (*Monatsschrift f. Geb.*, xxi., and xxxi.), toltz (*Gazette Médicale Strasburg*, 1866), Greenhalgh (*Lancet*, arch, 1867) and Kœberlé (*cf.* Keller, *sub* "Literature") *inter lios*; in other cases the patients died. Friedreich (Virchow's *rchiv.*, xxix.) punctured with a fine trocar and injected, as Joulin "Des cas de dystocie appartenant au fœtus." *Thèse*, Paris, 1863) ad shortly before recommended, a solution of morphia into the ac, likewise with a favourable result, and moreover without iving any pain. Prejudicial irritating injections must of course e carefully avoided. The electro-puncture of the sac carried out y Bacchetti (*Gazette Médicale Toscana*, May, 1853), in which he puncture of course is the chief thing, and the electric shock ecommended by Duchenne (Lesouef, "Remarques sur trois cas e grossesse extra-utér." *Thèse*, Paris, 1862) and given by neans of a powerful Leyden jar, will probably not be repeated wing to the irritating effect[1].

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[1] Duchenne's treatment has lately been successfully carried out by Lovring and andis (*Centralblatt f. Gynækologie*, 1878, p. 23), again by Landis (*ibid.*, 1880, p. 62), nd by Reeve (*Amer. Gyn. Transactions*, iv., p. 313).

If there are signs that the fœtal sac has ruptured, an attempt may be made to combat internal hæmorrhage, by applying bags of ice to the abdomen, by iced enemata, by compressing the aorta, by sand-bags and by bandaging the lower limbs; for the collapse stimulants and opium may be used, and if the patient survives the accident, the sequelæ (peritonitis, hæmatocele) are to be treated in the ordinary way. Sometimes it may be possible to avert the almost invariably fatal issue by abdominal section (removal of the blood, and ligature of the bleeding portions, followed by drainage), or even by extirpating the entire fœtal sac. But I cannot hold out much prospect of success to the latter suggestions; for the conditions are different from those in which recurrent or secondary hæmorrhage takes place after gastrotomy performed for the extirpation of tumours, indeed even at the post-mortem, it is usually very difficult to disentangle the anatomical connections of the fœtal sac. Moreover the removal of the latter *en masse* involves the division and ligaturing of the whole ligamentum latum and as a rule of a quantity of adhesions, and is an amount of interference which the woman suffering from rupture of the sac can scarcely survive. Nevertheless considering the present state of intra-abdominal surgery, the proposal (Kiwisch, Kœberlé-Keller) must not be rejected offhand.

§ 335. *b.* If the period at which rupture generally takes place has passed, *if the fœtus continues to develop within its sac, if therefore the 4th to 5th month has been happily reached,* an expectant treatment should be adhered to. Any interference at this stage would sacrifice the fœtus, which may possibly be saved at a later time, and expose the mother to much the same risk as would accompany the death of a mature or nearly mature child. A simple harmless disintegration of the fœtus, such as might occur during the first months, can no longer be looked for. It is true that, according to Puech (*l.c.*), the suppuration of the sac and the elimination of its contents are somewhat less dangerous during the earlier than during the later months, but this is not sufficient reason for killing or puncturing the ovum. Martin however (*Monatsschrift f. Geb.*, xxi.) saw recovery take place after such puncture, by the fœtal mass being expelled *per rectum*, but Simpson and Br. Hicks (*Lond. Obstetrical Trans.*, vii.) lost their patients after the operation; the danger of hæmorrhage from the vascular walls of the sac into the latter is very great at this period. In any case, if the condition is recognised and an expectant treatment adopted, it is of the utmost importance, that both the patient and her medical attendant abstain from anything that might cause irritation.

If the fœtus dies during the period under discussion, *i.e.* after reaching the 4th—5th month, the same treatment must be adopted as in a pregnancy that has advanced further, and in which the fœtus has died; we shall speak of this immediately.

§ 336. *c.* If the *pregnancy has reached its natural termination* according to the usual reckoning, if labour pains set in and the *fœtus is living*, the question arises whether the latter should be extracted by *gastrotomy* (*primary g.*). Such an operation seems at first sight to have everything in its favour. The child is saved, the rupture of the sac, which is so apt to occur during the "pains" or after a mature fœtus has died, and peritonitis &c. are prevented, while moreover the operation is performed at a time when the mother is still under favourable conditions. Nevertheless the danger is very great, much greater than from laparotomy performed on other grounds; partly because it is not rare to come upon the placenta in making the incision (according to Litzmann this happens once in every 5th or 6th case), when severe hæmorrhage sets in which is difficult to control; and partly because it will in any case be necessary to leave the fœtal sac and the placenta *in situ*, and this may afterwards *repeatedly lead to the most profuse hæmorrhage*, inasmuch as the placental circulation is carried on for some time longer. It is quite inadmissible (as was taught by Ramsbotham long ago) to remove the placenta at the time, for the hæmorrhage from the area of separation cannot be checked in these cases, as can uterine hæmorrhage, by contraction of the placental site. For these reasons, primary gastrotomy under such circumstances with a living child has been very unsuccessful; in 10 accurately recorded cases collected by Litzmann, 9 women soon perished[1], and out of the fœtuses only 4 survived for any length of time (more than 3 days). Thus even for the child in whose interest primary gastrotomy is mainly performed, the prognosis is unfavourable, probably because when extra-uterine, its development is not infrequently imperfect, and because in many cases it has been injuriously affected by the labour pains which preceded the operation.

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[1] Out of 10 cases collected by Keller 4, out of 20 collected by Parry 6 died; but, as Litzmann points out, we cannot base our treatment on the statistics of those authors, since some of the cases are imperfectly recorded.

The conditions therefore should be extremely favourable, before primary gastrotomy with a living fœtus is decided on. The evidence must be as clear as possible that the child possesses vigour and vitality, and also that the placenta will not be met with in making the incision. In other cases it is on the whole better to await the death of the fœtus, while watching the patient, keeping her quiet, lulling the expulsive efforts by opiates, and looking to a regular free action of the bowels &c.; if there is then reason to suppose that the placental vessels and sinuses are thrombosed, the time for operating has arrived (*cf.* § 338).

§ 337. If *primary* gastrotomy is performed, it must like every other laparotomy be done under strict antiseptic precautions. The abdominal wall is divided along the linea alba, the fœtal sac opened to the necessary length and no more, and the edges of the latter brought into exact apposition with those of the abdominal wound. The fœtus is then extracted by the head or lower extremity, and the sac drawn out as far as can be done without injury to any abdominal viscera that are adherent to it. The portion drawn out is next to be removed, the remainder together with the placenta lying in it (the end of whose umbilical cord has been ligatured) being fixed in the abdominal wound, if necessary by stitching it to the edges of the latter, which is then closed as far as the point at which the portion that was drawn out passes through. The after treatment will chiefly have to do with the suppuration and gangrene of what has been left behind, with septicæmia and secondary hæmorrhage, and must be conducted on the principles pursued in complicated ovariotomies; success chiefly depends, as in the latter operation, on the most careful and minute attention being paid to every step of the operation, and during the subsequent period. In some cases, it may be possible to extirpate the greatest part of the sac; in others, where no well defined isolated sac exists, the adhesions of the ovum must merely be separated and all its former connections must be left behind, although without ever departing from the principles which have been stated above.

the placenta is met with in incising the sac, the incised must be firmly ligatured and be drawn out, after the free cation to it of a strong styptic.

stly, if during the period which we are discussing, *i.e.* e the onset of, or during, the labour pains, the *sac ruptures*, ary gastrotomy is urgently called for when the child is inasmuch as it is scarcely conceivable that the mother survive the consequences of the blood and ovum being arged into the free abdominal cavity. For the same n I would recommend the operation, even when no signs tal life can be made out, but it must be done immediately the catastrophe; if some time has already elapsed since it red, if peritonitis has supervened, it is best to act, as if we o do with a dead fœtus still within its sac.

338. *d.* In such a case, *i.e.* if the *fœtus is dead*, the best is at first to maintain an expectant attitude, while treating symptoms that arise after the death of the fœtus, and to h to what issue the case is tending. If the first effects of hock have passed, adhesions will almost always have formed een the fœtal sac and the abdominal wall; the placenta then ually atrophies, its vessels thrombose, and this is the best to remove the fœtus by *secondary gastrotomy*. The sac is less vascular, an incision through the placenta, if required, be bloodless, the separation of the latter will be easier, hæmorrhage will meanwhile be absent or only moderate in tity; in point of fact we have merely to do with an inflamed ppurating cavity which is shut off from the abdomen. It is ver generally difficult to say when the favourable moment has ed; several months must doubtless elapse since the death e fœtus occurred; if the condition of the mother permits it, well to wait 4—6 months, although not much beyond that . If on the other hand the mother gets into an alarming ition soon after the death of the fœtus and directly owing to d in these cases any decomposition within the fœtal sac is of cial importance), the sac must at once be emptied. Nor is any reason to wait long, for with decomposition going on, is scarcely likely to be much hæmorrhage from the placental since decomposition soon leads to obliteration of the ls. The secondary gastrotomy must of course be performed actly the same way, as is directed in the preceding paragraph.

When the patient is not seen till *many* months after the death of the fœtus, it is generally sufficient merely to open the sac, and to extract the fœtal parts. This too however must be done with every precaution, since even at this late period it is never quite certain that the sac is completely adherent to the abdominal wall, and if not, the abdominal cavity might be opened; in these cases the usual rules directing that ordinary suppurating abdominal cysts be opened early, hold good.

Keller has collected 19 cases in which abdominal section was performed after the death of the child, but before rupture and fistulous passages had occurred; 16 of them were successful. Parry discovered 14 deaths out of 36 cases. Litzmann out of 33 found the same number of deaths, which are equal to a mortality of 39 and 42 per cent. This is a better result than in non-interference.

§ 339. If during the advanced period of pregnancy a bulky portion of the ovum descends into the pelvic cavity, and pushes the posterior and lateral vaginal walls before it, the latter may be divided, and the fœtus extracted through the pelvis; this has been done by Keith, Thomas and others, sometimes with the help of instruments (*elytrotomy*). The operation will be specially indicated, if a large part of the child can be felt in the pelvis, since we may then feel tolerably certain that the placenta does not lie beneath the lower pole of the fœtus, and therefore will not be injured during the incision. The further the ovum projects into the pelvic cavity, the more boldly may elytrotomy be performed, while conversely when the fœtal sac lies further from the vaginal fundus, the operator can no longer be so certain of opening the sac, and the hand which is introduced with the object of extracting the fœtus might cause considerable injury in the pelvic and abdominal cavities, or bring the emptied sac into direct communication with the latter. Elytrotomy, when performed under the first-named conditions, has yielded remarkably good results, doubtless because, when sufficient care has been used, the abdominal cavity has not been opened, while at the same time the discharges have a free exit below.

The mode of operating presents no difficulty, although the hæmorrhage caused by the incision might be alarming if a lobe of the placenta or some great vessels were injured; hence Thomas recommends that the sac be opened by the galvanic cautery (Schmidt's *Jahrbuch*, vol. 171, p. 271). The umbilical cord must be ligatured, the placenta being left undisturbed, till it can be removed without much violence, and without hæmorrhage. The emptied fœtal cavity will be treated like an abscess cavity, by drainage and irrigation in the usual way, varied according to circumstances.

§ 340. When the fœtal mass is suppurating, and the sac is about to give way, it must be encouraged to do so by poultices, and an incision should be made as early as possible at the point at which rupture is anticipated (in 32 cases collected by Parry, only 3 women died). As soon as there is an opening, any fœtal parts that lie near it, should be extracted. It may be necessary to enlarge fistulous passages, to keep them open by force, or to make them accessible by dilating the rectum or the urethra. Duncan (*Edinburgh M. Journal*, July, 1863) extracted quite a large fœtus through the rectum, although in all these operations the greatest caution is necessary, so as not to use such violence in removing the fœtal parts, as might tear the often lacerable abscess wall; no incision is to be made which might involve the peritoneum, and open the abdominal cavity. I need hardly add that the suppurating cavity must be carefully drained and washed out with a solution of carbolic acid, while the strength of the patient is sustained by good nourishment and nursing.

A woman who has escaped the dangers of an extra-uterine pregnancy, should be warned of the risk to which a fresh pregnancy will expose her.

b. Anomalies of the Decidua.

1. *Hypoplasia.*

§ 341. Premature atrophy or imperfect development of the decidua vera is not rarely found when immature ova are expelled, and in itself is not injurious. The opposite effect however is produced when the *reflexa* and *serotina* are atrophied. If the latter is very small, only a limited portion of the surface of the ovum will be in connection with the uterine mucous membrane, and the serotina will be found abnormally long, stalklike, and drawn into the bag of reflexa; the ovum is then suspended in the latter, and supported by the uterine wall. In this way the ovum may be detached by its own weight, through the tension which it exerts on the small serotina, and as a result of uterine contractions; or an extravasation of blood may take place which entirely destroys the serotina, and makes it impossible, after the expulsion of the ovum, to recognise how the latter was attached.

The reflexa may be absent from the very first. Under such circumstances the chorionic villi everywhere grow into the vascular vera, and the placenta is apt to be formed over too extensive an area (*cf.* § 359); this, as the enlargement of the uterus does not keep pace with the growth of the ovum, may lead to abortion, and even to the formation of a placenta prævia. It is more common however, although still rare, for the reflexa to be ill developed, and to disappear prematurely. The ovum is then merely covered by chorion (fig. 68), and hangs from a stalk of serotina. Uterine contractions may, in such cases of atrophy, bring about a separation of the ovum, or, by the stalk being considerably drawn out, drive it into and through the internal os, so that it remains for some time lying in the cervix and is nourished to some extent by the vessels of its pedicle (cervical pregnancy—Rokitansky).

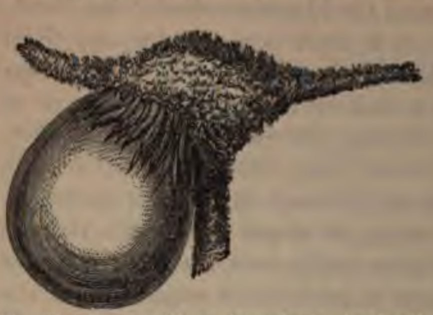
Fig. 68.—Ovum with an imperfectly developed decidua; external surface of the vera (Duncan, *Researches in Obstetrics*, p. 296).

2. *Hypertrophy.*

This has already been described in §§ 305 and 306.

3. *Hæmorrhage—Aborted Ovum and Mola Sanguinea.*

§ 342. Hæmorrhage into the vera and decidua (apoplexy of these parts, leading to their destruction) is either due to uterine contractions called forth by some remote cause which leads to the separation of the ovum, or else is produced by external agents (violence), by congestion (diseases and especially displacements of the uterus), or (and above all) by the already mentioned diseases of the decidua itself (*cf.* also § 257). Hence it will be intelligible how this hæmorrhage is a very common accompaniment of abortion, either as consequence or cause, and it may be difficult in an individual case to make out the exact sequence of events, and the causal connection of the changes found in the ovum.

The importance of primary extravasations of blood as regards abortion will vary with their size, the period of their occurrence and especially with their situation; a slight extravasation during the first or second month is much more injurious to the delicate ovum than a more copious one at the fifth or a still later month. Extravasation into the serotina is more serious than a similar one into the vera; extravasation into the reflexa is only injurious when it occurs at a time when the latter still serves for nourishing the ovum.

Extravasations into the vera are found on its uterine surface, in its substance and on its inner surface; the membrane is often destroyed to a large extent, the blood being effused between vera and reflexa. Extravasations into the serotina may also reach the latter situation, after breaking through the point at which the vera and reflexa are reflected; but the blood more often extends from the placental site between reflexa and chorion, causing the latter together with the amnion to bulge into the fœtal cavity, and it then leads to so much pressure on the ovum, that the embryo, if not already dead, perishes; or else the fœtal cavity bursts. Now and again the chorion is broken through, and the amnion separated from it over a large area; sometimes the amnion and a quantity of blood are found free in the fœtal cavity.

§ 343. If the ovum does not burst under the pressure of the effused blood, the amniotic fluid decreases somewhat in quantity after the death of the embryo. The embryo itself—as yet merely a mass of cells—undergoes maceration, and is broken up into its elements, disappearing entirely or all but a small remnant. Sooner or later a sac formed of the amnion and chorion—these membranes being infiltrated by more or less altered effused blood and with larger or small portions of the decidua still clinging to them,—and filled with a serous or a sero-sanguineous fluid, is expelled, in which nothing but cellular detritus, or in many cases still a remnant of the umbilical cord is found—aborted ovum (*false conception*—Montgomery). The whole mass is usually surrounded by blood clots; sometimes a small placenta with atrophied umbilical vessels, is also found in such ova. Those vessels however will only be present, when the extravasation occurred at about or after the third month; and this is rare in these cases, for aborted ova almost always date from the second month.

If the ovum soon ruptures through the pressure of the effused blood, the embryo passes out and is lost, while the coagulated blood with the membranes remains for some time *in utero*, before being expelled. If it remains long, the clots become tough and firm, and (inasmuch as all the retrogressive metamorphoses of effused blood may occur) may form solid masses, which may or may not continue to enclose a small amniotic cavity, but in which the original structures, especially of the chorion and the decidua, can still be demonstrated—*mola sanguinea*. The decidua is often greatly thickened and hypertrophied, and in places is firmly adherent to the uterine wall; this may be the reason why the blood-mole remains for a long time in the uterus, and why the membranes and the coagulum undergo still further metamorphoses. These metamorphoses lead to the deposit of lime-salts, and to pigmentation &c.—changes which induced older authors to describe various kinds of mole. When the chorion and amnion (or only the latter after rupture of the

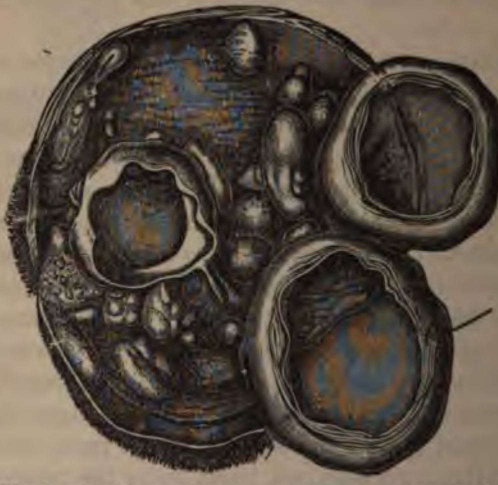

Fig. 69.—Blood-mole with extravasations and blood-cysts on the fœtal surface. (Hohl.)

former) have been raised into a bladderlike swelling by an effusion of blood, the so-called blood-cysts are formed. These are cysts of variable size, containing a sanguineous fluid, or else a clear discoloured fluid derived from the blood-serum (fig. 69). The blood-mole is rarely larger than an orange, and is usually expelled between the third and fifth month, although occasionally much later. During this process owing to the above-mentioned abnormally firm attachment to the uterine wall, remnants are readily left behind, which may lead to secondary hæmorrhage and to the formation of fibrous polypi.

c. *Anomalies of the Chorion—Hyperplasia of the Chorion, Myxoma of the Chorionic Villi, Vesicular Mole.*

§ 344. The vesicular or cystic mole consists of a conglomerat of vesicles filled with pale, and for the most part clear, fluid, which are surrounded by the decidua, and in places project through it. They vary in size from a walnut to a millet seed, and are connected with each other by thin threadlike stalks. The vesicles however are not arranged like berries on short stalks starting from a common one; on the contrary the latter pass from one vesicle to another, present spindlelike cystic dilatations of their own, and give off lateral offshoots of a similar formation at the point of bifurcation small stellate or triangular vesicles are often seen. In the fresh condition the vesicles are separated by coagulated blood; lastly, they are all held together, in addition to the envelope of decidua, by a fine network lying in the middle of the bunch and resembling that of the placenta (fig. 70).

The vesicles are degenerated chorionic villi. The degeneration consists of an abundant proliferation of the villi, and of hypertrophy of the internal mucoid matrix of the individual villus, the nuclei and cells increasing like the intercellular substance. Through a great accumulation of the latter, and a mucous degeneration of the cells (physaliphorous cells), the villi come to form the vesicles described; and inasmuch as the cystic degeneration not only affects the apex of the villus, but also various points in its length, the vesicles, as already mentioned, appear to form rows. Accordingly in the fresh condition (and this is confirmed by my own investigations), each vesicle has an epithelial covering; next to this comes the ground substance consisting of a closer tissue with small stellate cells, which are connected with the separate fibres of the tissue; this layer encloses the soft gelatinous mucous tissue which can be drawn out into threads and is often fluid. The vessels of the villi are almost always atrophied, although netlike capillary ramifications

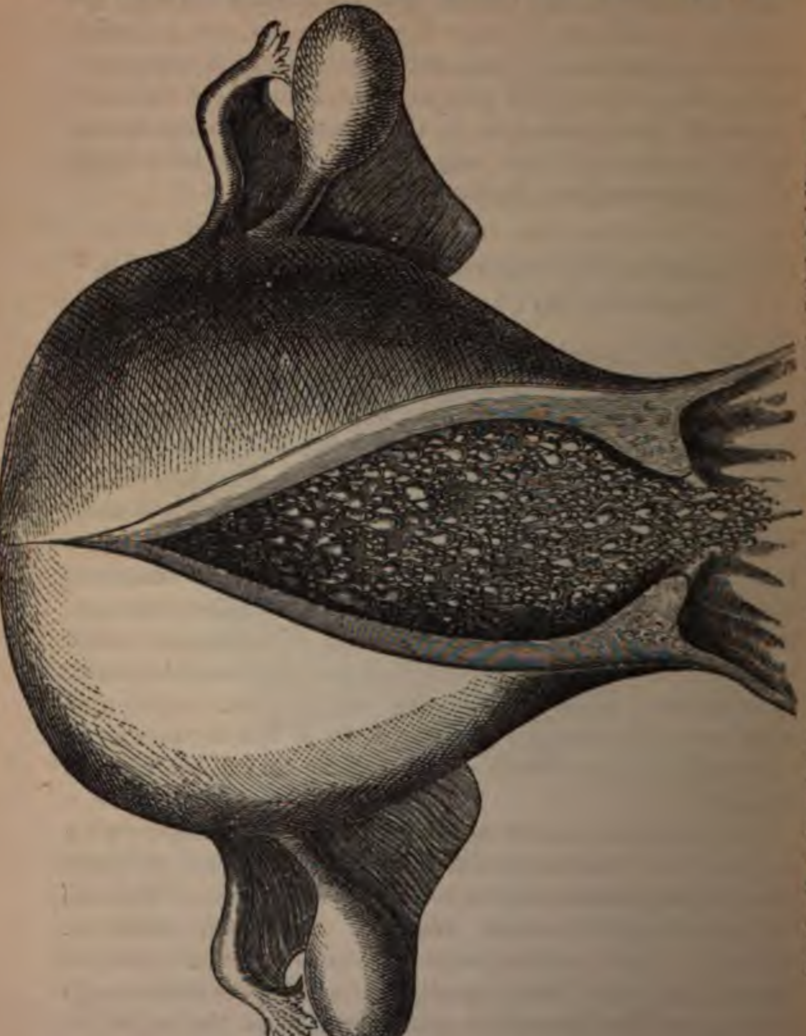

Fig. 70.—Vesicular mole in the uterus. (From a preparation existing in the Pathological Museum here, described by Waldeyer and Jarotzky in Virchow's Arch., vol. 44.)

are sometimes found in the outer stratum, especially when the degeneration is partial, and the fœtus alive. The substance forming the stalks is very much like *Wharton's jelly* and consists of a firm mucous tissue, whose fibres are arranged longitudinally and pass imperceptibly into the homogeneous layer of the vesicles. The fluid contained in the latter shows a great similarity in composition to liquor amnii, but in addition to albumin it contains comparatively much mucin. The larger vesicles have more water, but less mucin than the smaller ones; on the other hand the amount of solid matters, and especially of albumin, increases with the age of the mole, while the quantity of mucin decreases.

If the vesicular mole is formed at a *very early date*, as is the rule, the whole surface of the ovum undergoes degeneration, the embryo perishes, is disintegrated and no remnant of it can be found; the amniotic cavity forms a small space inside the mass, and may be difficult to discover. When the degeneration sets in after the *placenta is formed*, it is limited to the latter, although the whole surface of the ovum generally appears on superficial observation to be covered by the cysts; the fœtal cavity in this case is usually very distinct, and the remnant of the embryo or even the whole (atrophied) fœtus is present in it. Sometimes a simultaneous increase of the liquor amnii takes place. Degeneration of certain lobes of the placenta in the midst of healthy ones —*partial myxoma*, indeed in some places in different cotyledons, is also met with, and under such conditions no injury need result to the fœtus. In exceptional cases, isolated vesicles are found attached by stalks to the smooth surface of the chorion, where it is not involved in the formation of the placenta.

The co-existence of a vesicular mole with a well developed ovum and healthy fœtus, has several times been seen (Hildebrandt, *Monatsschrift f. Geb.*, xviii.; Davis, *London Obst. Transactions*, iii.; Pepper, *Am. Journal of Obst.*, iv., p. 735, &c.); in some cases the mole was expelled long before the mature child (Montgomery). The formation and expulsion of a blood-mole, after the expulsion of the portion which had undergone vesicular degeneration, has also been observed.

A vesicular mole may attain the size of a child's head and the weight of 1—2 kilo. (ca. 2—4 lb.). *Cf.* Elsaesser.

§ 345. The *mole is connected with the uterine wall* by means of the decidua and, when the latter is hypertrophied, the connection may be very firm; thus are to be explained the cases in which portions of the mole have remained for a very long time in the uterus, and in which partially degenerated pieces of placenta were discharged long after the expulsion of the fœtus. But there are also some cases on record (Volkmann; Waldeyer in Virchow's *Archiv.*, vols. 41 and 44; Krieger, *Berliner Beiträge*, i., p. 10), in which the degenerated villi continued to invade the blood channels of the decidua serotina to which from an early period they had access, and in which they passed from them into the sinuses of the uterine wall; indeed they may involve the uterine substance as far as its peritoneal coat, and to such an extent, that after the removal of the mole, the uterine wall presents a trabecular reticulated appearance similar to the internal surface of the heart, and in places is so thin as to be translucent—interstitial or intra-parietal, intra-vascular *destructive mole formation*. In the two first of the instances mentioned, death took place by hæmorrhage; in Krieger's case peritonitis came on and carried off the patient. The case reported in the *Lancet* (Feb., 1840) by Wilton, and reprinted in *Annal. f. Frauenkrankheiten*, iv., p. 146, doubtless belongs to this class; the uterus was perforated, and opened into the abdominal cavity, hæmorrhage into the latter causing death. In Volkmann's case, the morbid formation merely affected the placenta, giving rise to an irregular cavity in the substance of the uterus, which was separated from the uterine cavity by a membranous septum formed of

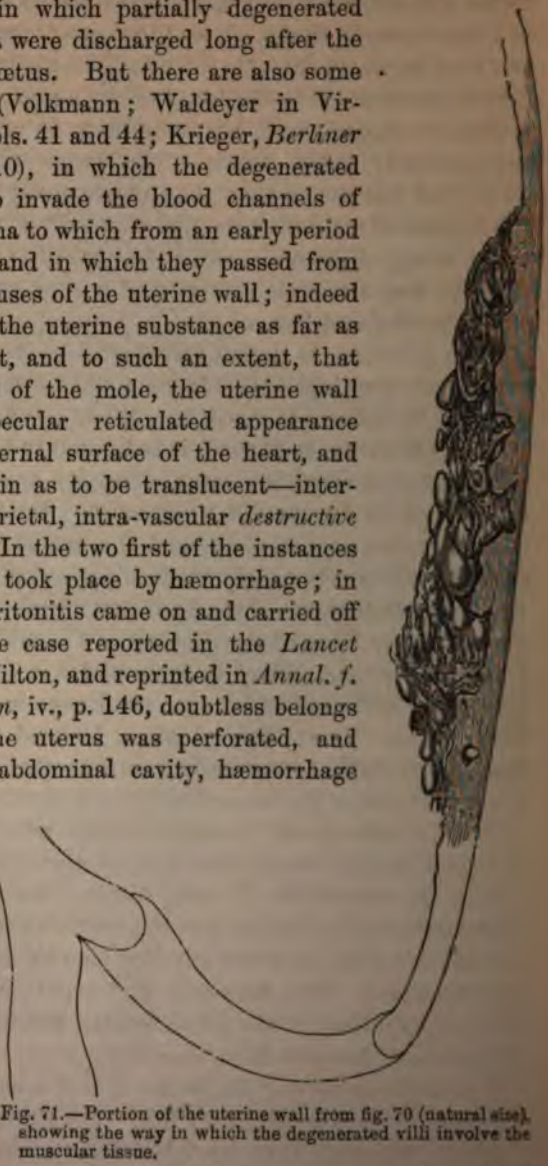

Fig. 71.—Portion of the uterine wall from fig. 70 (natural size), showing the way in which the degenerated villi involve the muscular tissue.

decidua; the mole projected through an opening in the septum ca. 3 cm. (1·2 in.) wide into the uterine cavity lying below it. In Waldeyer's case, the whole superfices of the ovum was degenerated, the decidua being unaffected and pushed forwards by the hypertrophied villi (fig. 71). The sprouting into the intra-parietal veins however is probably not so common as Waldeyer appears to believe; if it were, the spontaneous expulsion of the vesicular mole would be rarer, the accompanying hæmorrhage would be more profuse than it usually is, and we should doubtless hear of cases in which the artificial removal of the mole produced rupture of the uterine wall. Possibly some unusual morbid condition of the uterine tissues is necessary for the development of such destructive processes.

§ 346. The *cause* of the hyperplasia of the villi is unknown; indeed it is undecided whether it indicates primary disease in the ovum, or whether it depends on some irritation due to disease of the internal surface of the uterus, or to the maternal blood. That it is not a consequence of a very early death of the embryo, as is still often supposed, and of the associated arrested growth of the fœtal vessels into the villi, is clear, even though the villi may possibly continue to grow for some time after the death of the fœtus. Such a supposition is contradicted by the rarity of vesicular moles, compared with the much more common early death of the embryo, by this pathological growth occurring after the formation of the placenta has begun (which latter event must surely be due to the vessels growing into the villi), by the network of capillaries which is sometimes observed in the vesicles, by the fact that atrophied embryos are met with in the moles, and by the cases of partial degeneration. The death of the fœtus must therefore be looked upon as a consequence of the degeneration. The view which seeks to explain such degeneration by a morbid condition of the uterine mucous membrane (decidua) is supported by evidence of such disease obtained in different ways, and by the cases of partial degeneration, even if it is not correct, as Virchow stated, that moles are often met with more than once in the same woman (the case related by Majer in the *Württemberger Med. Corrblatt*, No. 38, 1847, of a woman who 11 times bore a mole in addition to a well formed fœtus is unique; Depaul, *Clin. Obst.*, i., 1872, p. 280, also records an instance of three molar pregnancies following upon each other).

But to assume the presence of a morbid condition, in order to explain those cases in which no disease can be found in the uterus is utterly unjustified. Under such circumstances it becomes extremely probable that the cause of the hyperplasia in many instances, if not in all, is to be sought for in an *anomalous development of the allantois*, all the more so as vesicular structures have also been observed in the umbilical cord. This view can also readily explain those cases of the degeneration of one twin ovum side by side with a normal second twin, or at any rate can do so more readily than the view that only a portion of the uterine mucosa was diseased.

According to the statistics of Bloch (28 cases), an advanced time of life seems to have more influence as a predisposing agent than the mere number of the pregnancies; although it is true that primiparæ are comparatively rarely affected. Moreover a rapid recurrence of pregnancies one after the other appears to favour this morbid degeneration; its recurrence in the same woman has also been several times observed, although speaking generally it is rare. The frequent co-existence of myxoma of the villi with dropsy in mother and fœtus is noteworthy (Storch, Runge).

§ 347. The *signs* of molar pregnancy are usually the following: the woman at first shows the usual indications of pregnancy, but before long the rapidly increasing size of the uterus is in marked opposition to the calculated period of the gestation; symptoms also of uterine irritation generally show themselves, viz. slight contractions, sacraic and lumbar pains, sympathetic gastric disorders, a copious, thin, slimy, sometimes blood-tinged discharge from the uterus, partly due to irritation of its mucous membrane, partly derived from ruptured vesicles; occasionally one or more entire vesicles are found in the discharge. The general health often suffers greatly, and a hydræmic condition is, as already mentioned, not rarely seen. The rapidly enlarging uterus soon begins to manifest signs of irritation by stronger contractions, all the more so as the rapid enlargement tends to detach the ovum. During the contractions, the thin slimy fluid derived from the vesicles (sometimes also from the amniotic sac) together with blood is discharged in considerable quantity; the hæmorrhage may be very severe, and has many a time seriously endangered life and even proved fatal. The mole is broken up during the course of expulsion, groups of vesicles lie in the discharged blood, the remainder hang in the lower segment of the uterus and are generally removed from there, since owing to the hæmorrhage the spontaneous expulsion is often not waited for. The hæmorrhage ceases, when this process is complete, unless some portions are left behind owing to their firm attachment, when they give rise to symptoms which will be described under "abortion." In partial myxoma too labour is often terminated prematurely, either directly owing to the degeneration or owing to the secondary death of the fœtus; hæmorrhage and retention of the degenerated mass after labour are not uncommon. When a mole co-exists side by side with a healthy ovum, it may, as already mentioned, either be expelled before the latter (occasionally months before), or both are discharged together, or the mole may be so last.

The *diagnosis* can only be made with certainty, when parts of the mole are actually seen. Even before that the relatively rapid enlargement of the uterus, its tense elastic wall without any distinct fluctuation (similar to that found with soft juicy myomata), the thin, slimy or sanguineous discharge, the contractions which recur from time to time; the stretching of the lower segment of the uterus, together with the impossibility of feeling fœtal parts, of making out ballotement, or of hearing the fœtal heart beat—would seem to justify the opinion that we have to do with a vesicular mole. But all these signs are unreliable, especially as they are rarely all well marked, and in individual cases present numerous variations. Of course there is no sign whatever of partial degeneration, not even when the fœtus has died in consequence.

§ 348. The *prognosis* is, generally speaking, not unfavourable. It depends principally on the amount and duration of the hæmorrhage, and in this respect molar pregnancies are on a par with those complicated by placenta prævia. The earlier such a case comes under observation, the more quickly the uterus can be emptied, if such a course is called for, and the more completely this is done, the better. The only exception is in the destructive molar formation, for this, from what is said above, gives rise to the most dangerous conditions.

§ 349. *Treatment* can therefore merely deal with symptoms both before and during the labour, and must entirely depend on the urgency of the case. Amongst these symptoms, hæmorrhage alone calls for energetic interference; the expulsion of a few vesicles does not do so, since after such an occurrence the pregnancy may progress, and since the degeneration may be only partial or perhaps even extra-placental. If the hæmorrhage is copious, plugging should be resorted to, and ergot given internally and subcutaneously (ergotine). Under some circumstances, *e.g.* when the dilatation of the cervix is delayed, it may be very useful to dilate it by laminaria tents, followed if necessary by small india-rubber bags; these not only cause dilatation and induce pains, but form an admirable tampon. An attempt should next be made to empty the uterus by means of expression; internal manipulations should be deferred as long as possible, bearing in mind the possibility of breaking up the mole and of some of its portions remaining behind, and still more the possibility of destructive changes having taken place in the uterine wall and of the injury (perforation) which is so easily caused in these cases; such a proceeding is only permissible when the cervix offers no resistance whatever to the introduction of the hand into the uterine cavity, and when expulsion cannot be brought about in any other way. The emptying of the uterus by means of instruments is entirely forbidden for the reasons already stated. Considering the uncertainty of the diagnosis, it will only be advisable to stimulate the uterus to activity before the spontaneous onset of pains, when the symptoms are very severe and seriously affect the health of the woman. Under such circumstances, there is all the more justification, since it is not difficult to satisfy oneself that there is no living fœtus, and the same treatment is desirable in the case of hydramnion and other pathological intra-uterine products. Special care must be used in insuring thorough involution of the uterus after the expulsion of the mole. Retained portions are to be treated like similar portions left after abortion (*cf.* § 409).

§ 350. *Hyperplasia, myxoma of the non-villous portion of the chorion.* This variety was first described by Breslau and Eberth (*Wien. Med. Presse*, No. 1, 1867; Virchow's *Archiv.*, vol. 39, p. 191) as "*diffuse myxoma of the fœtal membranes.*" It is characterised by a soft gelatinous thickening of the chorion; amounting to as much as 5 mm. (·2 in.), and consisting of a mucous, otherwise homogeneous ground substance with fine delicate fibrillæ and numerous round spindle- and star-shaped, in part physaliphorous, cells; the amnion is of tough texture, the so-called intermediary layer being little developed and quite absent in places. The surface of the chorion shows a number of flat, readily fluctuating elevations as large as a pea or bean. During labour the thickening was for the time being mistaken for a serous infiltration of the skin of the head; the fœtus was alive, but its epidermis was detached in places; no evidence of syphilis could be discovered. The placenta, decidua and umbilical cord showed nothing abnormal. Such myxomatous hyperplasia of the chorion læve may also occur to a *partial* extent, as is shown both by the accumulations of a gelatinous substance in the subamniotic portions of the placenta mentioned by Rokitansky (*Path. Anat.*, iii., 1861, p. 546), which point to it, and by the case published by Winogradow in Virchow's *Archiv.*, vol. 51, p. 146), where a swelling as large as a goose's egg was found in this region; it was of delicate consistence, tremulous like jelly, without fluid contents, but entirely similar to Wharton's jelly and 3 inches distant from the placenta.

d. Anomalies of the Amnion.

§ 351. 1. *Adhesions of the amnion with the fœtus* by means of membranous threads, cords and loops which pass from the fœtus to the amnion, or from one part of the fœtal surface to another, are of special importance, on account of their causative relation to fœtal deformities. These *filamentous connections or fœto-amniotic bands* (Simonart) owe their origin to very early agglutination and adhesion of the amnion to the surface of the fœtus in consequence of inflammation, or in some cases probably to arrested development, or to the amniotic folds having developed in some abnormal manner. It can no longer (in the face of what we now know of the nature of inflammation) be urged in opposition to the view that the anomaly arises through some inflammatory irritation which is transmitted from the skin of the fœtus to the amnion, that the latter is non-vascular in structure; should the amniotic folds be abnormal in shape, or not be sufficiently raised from the embryo, or be so too late (for some unknown reason, perhaps on account of an inadequate or delayed secretion of liquor amnii—G. Braun), the two opposed surfaces may grow together. The adhesions then lead to arrest of development, generally to fissurelike depressions of the affected parts of the embryo. When the liquor amnii increases in quantity and the amniotic sac is distended, the adhesions are easily drawn out to threads and cords which by means of tension or constriction may cause malformation or local imperfection of parts (self-amputation); the fœtus may be abnormally curved, its joints may be in a condition of rigid extension, even of over-extension. Sometimes in such a deformed fœtus, at a part which is in close connection with the malformation, merely loose bands are left, for example a divided thread; at other times nothing remains except the cicatrix, where the thread was attached; such threads and bands have also been found attached to the amnion by one end only.

According to G. Braun (*Œsterr. Zeitschrift f. prakt. Heilkunde*, Nos. 9 and 10, 1865), where there is an unusual accumulation of amnio-chorionic liquid during the later period of pregnancy, the ***amnion may tear***, while the chorion remains intact; the former may then be rolled up through the active fœtal movements, and thus be twisted round the umbilical cord or round fœtal parts, and in this way lead to the death of the fœtus.

§ 352. 2. Unusually *great wrinkling or folding* of the amnion, or abnormal development of the carunculæ (*cf.* § 91) may possibly only arise after the death of the fœtus has taken place, owing to the diminution in the quantity of liquor amnii, and to the continued growth of the amnion.

§ 353. 3. Winkler (*Arch. f. Gyn.*, i., p. 350) found a *cyst* in the amnion, at the place where it passes on the umbilical cord; it measured 1·5 cm. (·6 in.) in length, 1 cm. in width, and lay with its longitudinal diameter directed towards the cord; the cyst was certainly not a rudiment of the allantois, nor did it arise from a liquefaction of the gelatinous tissue of the cord; it was imbedded in the connective tissue of the amnion, and had originated in it. Ahlfeld (*ibid.*, xiii., p. 165) has described a conglomerate of little cysts, which was 3—4 cm. long and 1 cm. (·4 in.) wide; in this case the vesicles were lined with amniotic epithelium, and had arisen by the amnion becoming folded, and the contiguous parts growing together.

e. Anomalies of the Liquor Amnii—Hydrops Amnii.

§ 354. Abnormal composition of the liquor amnii probably depends in most cases on the admixture with it of fœtal products. It is therefore especially common, when the fœtus has perished, although occasionally seen when the latter is alive, either diseased or healthy; in such cases the constituents which render the liquor turbid and deprive it of its simplicity of composition, are either derived from the contents of the fœtal intestine which have been evacuated, or they are products of the decomposition of its epidermis and of the fat deposited on it. It is however not easy to disprove the possibility of abnormal constituents of the liquor amnii being derived from the maternal system, since we cannot exclude the possibility of the latter assisting in the production of normal liquor amnii (*cf.* § 92).

We spoke in § 351 of an unusually *small quantity* of liquor amnii leading to the formation of amniotic bands. Sometimes the quantity is remarkably small, even during the later period of pregnancy; the uterus then appears small and firm, the movements of the fœtus are impeded, and the mother often feels them to be strong and very unpleasant. I have seen no other bad results during pregnancy, although I am bound to admit the possibility, as authors assert, of the almost complete absence of the protection usually afforded by the liquor amnii leading to more serious consequences, especially for the fœtus.

During labour, the period of dilatation may be abnormally prolonged through the presenting bag of membranes not being formed at the proper time, and also through a delay in the rupture of those membranes.

§ 355. The commonest anomaly is an *excess in the quantity* of the liquor amnii, *i.e.* dropsy of the amniotic cavity.

Hydrops amnii.

The limit at which the quantity of liquor amnii becomes pathological cannot be absolutely settled, since its quantity varies even under ordinary conditions. We must therefore only speak of the quantity as morbid, when it injuriously affects the relations between fœtus and uterine cavity, or when the great distention of the latter causes trouble. This generally happens when the quantity of the liquor amounts to 2—3 litres (3·5—5 pints); but in not a few cases the quantity is much greater.

From what has been said in § 92, the *causes* of such an increase must mainly lie in the fœtus and the placental and umbilical vessels, *i.e.* (*a*) in an excessive renal and cutaneous secretion on the part of the fœtus, and (*b*) in the capillaries which were called by Jungbluth vasa propria of the boundary membrane of the placenta, remaining open for a longer time and to a more considerable extent than usual, in short in mechanical disorders of the fœtal circulation, especially of that through the cord. With this accords the fact that a perfectly well formed fœtus is rarely met with in cases of hydrops amnii (this is illustrated by a case under the care of my former assistant Dr. Hempel, in which a mature strong girl was born, in whom subsequently a congenital occlusion of the duodenum showed itself —*Jahrbuch f. Kinderheilk.*, 1873), that the child is often ill developed or dead (according to M'Clintock, out of 33 fœtuses 9 were born dead, 5 out of them macerated, and 10 died during the first few hours), in connection however with which we must of course not forget that the labour is generally premature[1]. This view moreover accords with the observation that the placenta is often found to be large and œdematous, sometimes membranous, that hydramnios is apt to occur in twin pregnancies (11 times out of the above 33 cases), in which fœtal anomalies are, as we know, not rare, and that almost always (according to M'Clintock, always) one ovum only presents the anomaly in question; further that the excess of liquor amnii as a rule only shows itself after the fifth month and then rapidly increases, and that the health of the affected mother is sometimes quite good, sometimes presents disorders which cannot always be brought into ætiological relation with the hydramnios, but are rather to be looked upon as sequelæ.

We cannot entirely exclude a maternal share in the excessive production of liquor amnii, since the fœtus is not invariably diseased, nor always becomes so after birth, while in some cases evidence of maternal syphilis is forthcoming[2], and since substances are known to pass from the uterine mucous membrane into the amniotic cavity. We must also mention in connection with the causation, the fact that multiparæ are much more often the subjects of hydrops amnii than primiparæ (according to M'Clintock, 28 : 5); also the peculiar circumstance that the fœtuses are in a large majority of instances of the female sex; of those recorded in my case books they were so almost without exception. M'Clintock met with 28 girls to 8 boys[1]. No abnormal character of the liquor amnii, *e.g.* a deviation from its normal characters, has been observed (*cf.* last note but one).

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[1] Luneau (*Centralblatt f. Gyn.*, 1877, p. 160) met with an interesting case in which the child was developed above the average; it weiged 5,750 grm. (12·5 lb.) and had a periphery of the head of 40 cm. (15¾ in.); further details of the case are wanting.

[2] Duncan (oral communication) has met with hydramnios in diabetes mellitus; the liquor amnii contained large quantities of sugar.

§ 356. The *discomforts* produced by hydrops amnii are purely of a mechanical nature. Owing to the excessive and rapid enlargement of the uterus (pendulous abdomen), the centre of gravity is displaced forwards, and progression is impeded. The abdominal walls are abnormally tense, and the traction upon them causes pain, especially at their fixed points. Owing to the vessels in the abdominal walls being stretched and flattened, and to the enlarged uterus pressing on the abdominal and pelvic walls, œdema of the vulva, labia and lower extremities arises, sometimes even ascites—all these symptoms being more marked in primi- than in multiparæ. Should the abdominal wall offer great resistance, the diaphragm will be pushed up; its range of movement is thus limited and dyspnœa ensues, or together with palpitation of the heart occurs on the slightest exertion; the stomach can admit but small quantities of food and digestion suffers; the patient grows thin. The renal secretion is only diminished in the severer degrees of the disorder; the urine sometimes contains albumin, but generally speaking no change in its composition is observed. Under the influence of all these circumstances, but especially of the excessive and premature distention of the uterine walls, and of the premature distention of the lower uterine segment, sometimes also owing to detachment of the placenta, and in not a few cases to intra-uterine death, labour generally comes on prematurely (in M'Clintock's experience, 14 times out of 33 cases); the natural termination of the pregnancy is rarely reached. The condition of the fœtus at birth has been already described. The "lie" in reference to the pelvis is generally cephalic, although an abnormal "lie" and "attitude" are not rare; it must however not be forgotten that premature labour and dead fœtuses are common, although apart from this hydramnios undoubtedly tends to cause irregularity of "lie," a tendency which is easily explicable.

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[1] Benicke (*Berliner Klin. Wochenschrift*, 1879, p. 773) however found 18 boys and only 4 girls in 20 cases. But I am inclined to think that he counted as cases of hydramnios such as others would not rank amongst them; this is indicated by the statistics he gives of the frequency of the anomaly (1—34 of the whole number of births) as well as by the average weight of his hydramniotic fœtuses (3,630 grm.= 8 lb.), which can hardly belong to premature children; and yet there is no doubt that such fœtuses are very often premature.

During its first period, *labour* is sluggish owing to the great distention of the uterine musculature, much as in twin births; if however, as sometimes occurs, the liquor amnii is all discharged at once, expulsion proceeds rapidly. Uterine inertia after the delivery of the child and its after-birth, and post-partum hæmorrhage are frequent; protracted involution is the rule. For the same reason the percentage of lying-in women who fall ill after hydramnios (and even the mortality) is higher than the average. I must also mention that when one of twin fœtuses is found diseased, it is usually the last-born (9 times out of 11, according to M'Clintock's experience).

§ 357. The *diagnosis* of hydrops amnii is not always easy, indeed in such a case it may be difficult to decide whether the uterus is actually pregnant[1]. This however will only very rarely happen, since, apart from the history of the patient, a repeated examination will even in the most difficult cases make it possible to feel and to percuss the outline of the uterus, and to make out fœtal parts in some region or other; moreover the lower segment of the uterus presents changes (softening, and especially expansion) such as do not occur in the non-gravid condition, and, as I have always succeeded in doing, the uterine souffle can be distinctly perceived over an extensive area. In the majority of cases the fœtal heart beat is also heard, although comparatively often it is inaudible, since a thick layer of fluid separates the auscultated area from the fœtus, while the latter is generally small and not rarely dead. Hydrops amnii is most often confused with twin pregnancy. The tense condition of the uterine wall in hydramnios, the generally distinct fluctuation, the difficulty of making out fœtal parts and of hearing the fœtal heart, while the contrary signs are present with twin ova, will generally decide the question. When not, we must content elves with a diagnosis of probability; where there is a com-tion of both conditions, nothing but labour will clear up the

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[1] I know of a number of instances in which the hydramniotic uterus was mistaken for a simple *ovarian cyst* and tapped; this has happened once in my own Maternity. Greater care in making the diagnosis will prevent such mistakes.

358. *Treatment* is of no direct benefit in this condition. we can do is to be guided by the symptoms in counter-g general and local discomforts; to support and fix the men with a binder, to enjoin a quiet mode of life, even if with the object of preventing too early or unexpected a harge of the liquor amnii. Indeed, the inconvenience and culty of physical exertion generally cause the pregnant an of her own accord to adopt such a plan. When the ciated disorders are so severe as to cause anxiety, the preg-cy must be prematurely terminated in the interest of the her, all the more so as there is but little prospect, for reasons stated above, that a strong and healthy fœtus can preserved. We must however always consider the latter to extent of postponing the induction of premature labour to as a date as possible.

uring labour the fœtal membranes should be ruptured as as the excessive accumulation of liquor amnii leads to delay he dilatation and to inefficient expulsive activity. But here n we must not interfere too soon, although on the other hand too late, *i.e.* we should anticipate the sudden and violent ture. The membranes should, if possible, be ruptured at a t high above the external os uteri, and always during the rval between two pains, so that the liquor amnii may flow off ly and leave the "presentation" and "attitude" of the fœtus hanged. During the after-birth period it is necessary to ch and compress the uterus with more than usual care, owing ts great tendency to relax; when the latter is completely tied, the abdomen should be bandaged, ergot given in large es, and involution encouraged by a strict *régime*.

f. Anomalies of the Placenta.

he pathology of the placenta has only been studied during last few years, so that our information on the subject is far n complete or satisfactory; this is epecially true in regard he primary share which maternal and fœtal elements respec-ly take in producing the alterations met with, and to the relation they bear to simultaneous changes in the fœtus. In what follows, I shall mention the main points that have been ascertained.

1. *Form and Situation.*

§ 359. We have already spoken of anomalies of *form*, in describing the normal placenta (§ 97 and preceding) and that of twins (§ 203). The variety described by Stein (the elder) as *placenta membranacea* has however not yet been referred to. It somewhat resembles the placenta met with in pachydermata, inasmuch as it forms a very extensive thin organ, and is said to depend on diffuse sprouting of the chorionic villi into the decidua reflexa, or, when this is absent, into the vera (*cf.* § 341). It is doubtful whether this rudimentary condition is actually met with in advanced pregnancy, or whether the report of its occurrence may not possibly be due to its having been confused with a small principal placental mass co-existing with several placentæ succenturiatæ; there are no recent researches relating to placenta membranacea. By *placenta spuria* are meant circumscribed patches of villi on the smooth chorion, which have no corresponding connection with the decidua; they are either single or multiple, are generally situated in the neighbourhood of the placenta, and have no importance.

It is not very uncommon to meet with a placenta, in which the edge is thick and heaped up, sometimes even reflected towards the fœtal surface, or one in which the coronal vessel is displaced considerably inwards away from the edge, so that the course of the vessel is much shorter than the circumference of the whole placenta. The peculiarity depends on an unusual thickness of the decidua vera or of the region where the reflexa joins the vera (*cf.* § 89), and has no significance for the fœtus. It is more frequent in premature than in mature fœtuses.

2. Anomalous *insertion* of the placenta, *i.e.* the attachment of the whole or a part of the organ to a segment of the body of the uterus which is stretched during labour, or the insertion of the placenta over the internal os (*placenta prævia*) will be dealt with further on.

2. *Atrophy.*

§ 360. Atrophy of the placenta is either a consequence of extravasations of blood between the villi, or of cellular hyperplasia, and in the form of the latter is described under placentitis &c.; or else it depends upon atrophy of the decidua (*cf.* § 341).

3. *Hypertrophy.*

§ 361. Simple hypertrophy, *i.e.* great bulkiness of the placenta in comparison to the fœtus, is especially seen in conjunction with hydrops amnii and with dead, above all with macerated, fœtuses; it depends upon hypertrophy of the decidua and its prolongations.

It appears, as Morgagni already pointed out, that the maternal portion of the placenta continues to grow for some time after the death of the fœtus. This explains why the uterine surface preserves a comparatively fresh appearance, while the fœtal portion is infiltrated with serum, and looks more or less discoloured, the vessels and the blood in it resembling those of the umbilical cord.

But an abnormally large placenta has been met with, even when the fœtus is perfectly healthy. Thus Spaeth and Wedl speak of a placenta 7 in. broad and 11 in. long, a lobe of which consequently reached as far as the internal os. Nor is it very rare to find, either all round or only at certain portions of the circumference of the actual placental mass which is held together by the chorion, that the maternal portion of the placenta has grown beyond the chorion to the extent of 1·5 to 5 cm. (·5—2 in.), and in considerable thickness (Hüter, Klob); *cf.* also § 359.

4. *Œdema.*

§ 362. Serous infiltration or œdema of the placenta renders the organ heavier and more voluminous, gives it a doughy and friable consistence and a paler colour. Both spontaneously and on pressure, there oozes out a reddish-yellow serum which was collected between the villi and their branches, not in them, although they often appear swollen and their vessels greatly enlarged. Other anomalies, especially extravasations into the placenta, are not rarely associated with œdema. Œdema does not seem to depend on disease of the uterus; the not infrequent co-existence of hydrops amnii, the presence of circulatory disorders in the umbilical cord (Simpson), the often badly nourished, dropsical, and even macerated fœtus all show that the disease is caused by the latter. Nevertheless the fœtus has been found healthy (Charpentier).

5. *Hæmorrhage and Hæmatoma.*

§ 363. Extravasations of blood may take place either into the serotina, so as to affect the uterine surface of the placenta (*utero-placental apoplexy*), and cause the latter to be separated from the uterine wall; or into the substance of the placenta. The latter site is the rarer, and even the *intra-placental* collections of blood (*placental apoplexy*) have generally travelled from the serotina into the parenchyma of the placenta; from there they may come to lie beneath the chorion &c.

Intra-placental hæmatomata form more or less circumscribed nodules which vary in appearance and consistence with the date of the extravasation, and which are the main origin of those structures which have been spoken of by different authors as fibrous nodules, indurations, hepatisations. They may lie in the tissue of the decidua, when they are traversed by thin partition walls, which frequently communicate with each other, consist of the large decidual cells and of narrow vascular channels filled with blood, and are abundantly infiltrated with leucocytes; or else the coagulated blood is actually in the cavernous cavities of the placenta, into which the villi project, and the condition must then be looked upon as a thrombosis of these cavities—*thrombosis sinuum placentæ* (Slavjansky, *Arch. f. Gyn.*, v., p. 360). In both cases the nutrition of the fœtus must suffer through the pressure on the villi and the further textural changes which follow on extravasation and thrombosis; indeed the fœtus may perish in consequence.

The cause of the actual extravasation is to be found in pathological structural changes in the decidua (*cf. supra* and "interstitial placentitis") and its vessels. When the new connective tissue has formed in the placenta (*cf. infra*), it shrinks, and thus leads to the obliteration of the vessels; this causes congestion of the neighbouring parts, and in view of the softness and friability of the tissues which are still unaffected, hæmorrhage results. The cause of the thrombosis is either to be found in irritation and inflammation of the walls of the cavernous spaces, or in a slowing of the blood current in the latter and the corresponding veins, dependent upon the maternal circulation; in this case the thrombi probably develop slowly, and gradually increase in size.

The further transformations of the blood are the usual ones. When the effusion has lasted for a time, the fibrin deposited by it generally becomes paler, denser and infiltrated with white corpuscles; or else fatty degeneration (fibrin nodules, hepatisation) takes places; calcareous deposits and the formation of cysts are not rare. Occasionally, the blood in places becomes transformed into whitish masses, consisting of densely crowded cells, very similar to those found in pus (Kleb, *Monatsschrift f. Geb.*, xxvi., p. 274), doubtless due to an immigration of cells into the coagulum. This occurrence has probably given rise to the idea that *pus was formed* in the placenta.

Lastly, it must be mentioned that the placental hæmorrhage may lead to a firmer attachment of the placenta, both at its edge and throughout its area of insertion, owing to the irritation and inflammation of the decidua caused by the hæmorrhage (Hegar).

Thrombosis in the chief venous trunks on the fœtal side of the placenta is sometimes observed, being generally associated with alteration of the walls of the veins; this disease is connected with the umbilical cord.

Extravasation into the fœtal parenchyma, i.e. into the villi, is very rare; as a rule it is only partial, although as will readily be understood, it is always dangerous for the fœtus. Doubtless it also starts from the umbilical vessels, or is secondary to disease of the villi.

6. *Inflammation, Placentitis.*

(*Cf.* also §§ 305—307).

§ 364. Our information about inflammation of the placenta has only been accurate, since the researches of Hegar and Maier have been published. According to these observers, such inflammation leads to an increase of the connective tissue, originating either (as is most frequent) in the tissue of which the decidua is built up, or else in the adventitia of the larger fœtal arteries; the condition has at different times been variously described and interpreted, according to the length to which the process has advanced. The disease starts with a more or less soft granulation stage (exudation), and ends in various forms of induration and degeneration. The new connective tissue is either formed in localised patches, or (which is rare) may be generally diffused. It gives rise to wedge-shaped nodules which make their way in between the arborescent villi, and may or may not have prolongations; when the stage of shrinking arrives, a condition similar to that of a hobnail liver results. The atrophied lobe grows pale, the gradual condensation of the tissues causes a narrowing and obliteration of the vessels running in them, the contained villi undergo atrophy and fatty degeneration. On the fœtal surface extravasations of blood take place, leading to hæmorrhagic cysts. The hypertrophied and sclerosed decidual tissue sends more or less firm fibres and cords into the uterine wall; more rarely the whole of the two surfaces become abnormally adherent.

The effects of this connective tissue growth sometimes show themselves during pregnancy, causing secondary hæmorrhage and abortion, or atrophy and premature death of the fœtus; secondary changes in the umbilical vessels and disorders of the fœtal circulation or diseases of its heart are also observed. During labour the separation of the placenta may be rendered difficult, owing to the dense bands of tissue and vessels which penetrate into the uterine wall, but this is much rarer than would be expected from the comparative frequency of the disease. The very friable and lacerable condition of the recently diseased portions more often causes them to be separated from the placenta, and retained *in utero*.

The causes of these inflammatory changes are to be sought for in endometritis existing before and during pregnancy. For this reason those changes are very apt to recur in the same person, and a prophylactic treatment is not only possible, but may in a measure be successful. When this form of irritation or inflammation is suspected in a pregnant woman, tepid baths should be ordered and saline aperients given. Simpson recommended potassium chlorate.

7. *New Formations, Degenerations.*

§ 365. We spoke in § 344 *et seq.* of hyperplasia, or *myxoma*, of the villi. Here we have merely to mention the fibrous degeneration of the mucous ground substance of isolated villous trunks and their ramifications, in which that ground substance becomes richer in fibrous elements and of a firmer consistence, more like that of ordinary connective tissue; it has been called *myxoma fibrosum placentæ* by Virchow (*Onkologie*, i., p. 415). The mass forms a thick, tough nodule on which smaller ones are placed, and on whose surface villous epithelium and some healthy villi may still be found, while in the middle of the fibrous tissue there yet remain some distinctly mucous patches infiltrated with fat and pigment. This was the case in the beautiful specimen described by Hildebrandt, *Monatsschrift f. Geb.*, xxxi. H. considers the cause to lie in the existing engorgement and in the varicose dilatation of the efferent vessel of the cotyledon, followed by endophlebitis and degeneration of the tissue of the villi. In a case recorded by Sinclair (*Journal of the Gyn. Society of Boston*, v., 1871, p. 338), all the chorionic villi are said to have been affected by the degeneration. The fœtus seems not to be injured by the change, provided that the latter merely affects a part of the placenta (*cf.* also Storch, *l.c. sub* "Literature").

§ 366. Under *sclerosis of the placenta*, Neumann (*Königsberger Med. Jahrbuch*, ii., 1860) describes a condensation of the placenta originating in the *villi*, by which it loses its spongy consistence, and grows discoloured, hard and dry; the division into lobes is obliterated and the organ forms more of a compact whole. This change is due to the villi becoming hypertrophied to such an extent that they entirely occupy the cavernous spaces which were originally filled with blood; hence, where those spaces should occur, nothing is found but closely interlacing villi, between whose numerous meshes runs a delicate net-work of trabeculæ of decidual connective tissue. The ground substance of the villi is transformed into a granular, opaque connective tissue infiltrated with fat, pigment and particles of calcified matter. It is easy to see how, where such a degeneration has taken place, fœtal metabolism will be interrupted, and that if a very extensive area is affected, the fœtus must perish. Whether this sclerosis actually originates from the hypertrophy of the villi, or whether it should not rather be looked upon as a consequence of the so-called inflammatory interstitial connective tissue hypertrophy, with atrophy of the villi, is still uncertain; the change is probably due to placental syphilis.

§ 367. *Circumscribed tumours* of the placenta have occasionally been found (*cf.* under Kolb and Whittaker), which were separated from the remaining tissue by a capsule of connective tissue, and must therefore be classed as true tumours. They generally lie on the fœtal side beneath the amnion, are of a connective tissue nature, sometimes poor in cells (fibromata), sometimes rich (sarcomata). They must be regarded as due to a conversion of the normal mucous tissue of the villi (partial myxoma fibrosum) into a fibroid tissue, or else as a cellular hyperplasia of the decidual prolongations.

§ 368. *Cysts* are not infrequently met with, quite apart from myxomata of the villi. They are always situated on the fœtal side of the placenta, and either possess *viscid* contents, in which case they are to be looked upon as having originated in local remnants of the allantois, or else (which is commoner) their origin is hæmorrhagic. In the neighbourhood of an extravasation, connective tissue diverticula form, which after degeneration and partial absorption of the sanguineous constituents and an increased vascularity of the parietes become transformed into cysts (with *serous* contents); *cf.* § 243.

§ 369. *Deposits of pigment* are found both in healthy and diseased placentæ and in varying quantities; sometimes in numerous places, sometimes only here and there. They originate from the hæmatin of the extravasations, or from the blood which is stagnating in the vessels, and are met with both in the interstitial connective tissue as far as the blood-containing cavity, and in the stems and branches of the villi.

§ 370. *Fatty degeneration of the placenta* may either be generally diffused or restricted to certain lobes. It must (if we except the normal fatty degeneration and atrophy of the peripheral villi which are met with in every mature placenta) either be looked upon as a premature fatty metamorphosis of the placenta, or as the final transformation of an extravasation or of interstitial inflammation (which then is apt to give rise to hæmorrhage); or else it is met with as an infiltration of the villi, and is then the result of a retrograde metamorphosis of the hypertrophied villi, *i.e.* of a secondary degeneration of the villi.

§ 371. *Calcareous deposits* in the placenta are not rare, and may start both in the maternal and in the fœtal portion. In the former and more frequent situation, the deposits are generally found on the uterine surface, and in the processes of the decidua which in the mature placenta separate the lobes of villi. They may form granular masses, irregular lines, needles or plates, and these are sometimes continued from the maternal to the fœtal placenta. The whole uterine surface of the placenta may be covered by them, and look as if particles of sand had been scattered over it. (Chambord found 500 concretions of considerable size in one placenta—*Lyon Méd.*, 1873, No. 25.) In rare cases they have been seen on the fœtal surface; Decker once found more than 200 "calculi" deposited on the latter, and following the course of the branching vessels. The "superficial" calcifications, which involve the opposed surfaces of the two great divisions of the placenta, are unimportant as regards the nutrition of the fœtus; they accompany a physiological deposit of fat at the end of pregnancy and an atheromatous change in the larger placental vessels, and, if we may argue from the analogy of senile calcifications, are probably to be associated with a slowing of the circulation, or with other vascular disorders. Whether the calcareous deposits lead to too firm an attachment of the placenta is very questionable, in view of their frequency; if they do so, it would be an unimportant event, associated with the connective tissue hypertrophy.

Calcification, originating in the *fœtal* tissue, is limited to the latter, and only found in the more minute villi, following the course of the capillaries and of the smallest vessels of the villi. The calcification however does not affect the whole thickness of the villus, for the calcareous matter is deposited in the wall of the vessel and in its lumen. The former situation seems to be the usual one, the calcification affecting the vascular walls all round, and at the same time forming a sheath round the lumen (Fränkel). This variety is only met with in the placentæ of fœtuses that have been dead for some time and are immature, and it seems probable that the death of the fœtus should be regarded as a consequence of the calcification of the capillaries, which must necessarily interfere with the exchange of blood and gas on the part of the fœtus. The relation however may be the converse of this, the deposition of lime being a consequence of the alterations which take place in the blood of the fœtus after its death.

8. *Syphilis.*

§ 372. The mode in which syphilis is transmitted from parents to fœtus has been discussed in § 268, so that I have here merely to describe the syphilitic changes in the placenta. My former assistant Dr. Fränkel deserves credit for throwing further light on this subject. According to him, placental syphilis is only found where hereditary or congenital syphilis exists in the fœtus, and both the maternal and fœtal portions of the placenta may be diseased. Where the former is affected, the so-called gummatous growths are met with in the decidua and its inter-cotyledonous processes, and the changes spoken of in §§ 306—307 as endometritis decidualis—endometritis placentaris gummosa—are also found (*cf.* also § 364); this happens when the mother suffered from syphilis before conception, or contracted it soon after the latter. The *fœtal* portion is always infected at the time of impregnation, *i.e.* through poison conveyed by the father, and may be so without the maternal portion being involved; or both portions may be diseased, as happens when the mother was infected at the same time as the fœtus. It is however not absolutely necessary for the placenta to be diseased, even though the fœtus is so. The change in the fœtal portion consists in a proliferation of the villi (due to granulationlike cells), which changes their shape, afterwards leads to obliteration of the vessels, and is frequently complicated by great hyperplasia and thickening of the epithelial lining of the villi; this change must from its mode of appearance and progress be regarded as of the nature of a chronic inflammatory process. In marked contrast to the usually badly nourished fœtus, the placenta in this disease is large and heavy; its texture is denser and thicker than normal, pale, yellowish-grey, somewhat homogeneous on transverse section, and the diseased areas are opaque. The villi are thick and plump, the intervillous spaces being filled by a proliferation of numerous medium-sized cells derived from the vessels, the epithelium also being proliferated; in the severer cases the vessels are obliterated and the villi totally atrophied. The cavernous blood spaces, into which the villi dip, are thus more and more filled out and narrowed; at last they disappear entirely. Owing to this hypertrophy of the villi and to the thickening of their epithelial lining, to the obliteration of the vessels, and the filling up of the maternal blood spaces, the processes of exchange between maternal and fœtal blood are hindered, and finally arrested, and the villus which is no longer functional falls a prey to the fatty metamorphosis which is so frequently seen in syphilitic placentæ. Where the morbid change is limited in extent, the fœtus may remain alive; in that case the healthy parts which separate the diseased areas are filled with blood, their vessels are dilated and extravasation into them is not rare; an interstitial connective tissue hypertrophy may also sometimes be observed, but without, any more than the extravasation, possessing any value for the diagnosis of placental syphilis. The amnion and chorion are here and there found to be unusually thick and opaque, owing to the deposition of fine granular matter, as well as adherent to one another in places; moreover on the fœtal surface of the placenta are numerous small white nodules, following the course of the vessels, and arising from local hypertrophy of the chorionic connective tissue. The intima of the branches of the umbilical arteries is sometimes thickened and atheromatous.

g. Anomalies of the Umbilical Cord.

§ 373. 1. The variations in the shape, length, and insertion of the cord, and in its formation where there are multiple fœtuses, have already been dealt with in the physiological part, §§ 99 and 203. But in this place we must mention the *insertio velamentosa*, or marginal insertion, into the non-villous chorion, since this anomaly, while unimportant as regards the development of the fœtus, may be a cause of danger or indeed of death to the latter, owing to the long curved branches of the umbilical vessels occasionally leading to interference with the circulation, or to the branches presenting or being pressed upon during labour, or to the rupture of the membranes involving a portion through which an umbilical vessel is running, and injuring this in such manner that the fœtus bleeds to death. This mode of insertion of the cord is due (Schultze) to the amnion being hindered from enclosing the structures that are contained in the cord symmetrically all round, from ensheathing and binding the various parts into a cord. The hindrance depends on the umbilical vesicle, or the duct, or vessels (rare) adhering to the amnion and chorion; if in such a case, the growth of the duct does not keep pace with that of the amnion, the sheath of the cord may cease growing round the constituent parts of the cord, or leave the vessels before they reach the placenta. The point of insertion may in this way be removed to the fœtal end of the cord, *i.e.* to that opposed to the placenta. Insertio velamentosa is often met with in the placenta of twins and triplets.

2. *True Knots.*

§ 374. These may be formed during pregnancy or at the time of labour, and occur once in about 200 births[1], although only where the cord is long. Sometimes knots that originated during pregnancy, co-exist with others formed during labour. The former variety is more tightly knotted, smaller and more difficult to unravel than the latter; moreover Wharton's jelly is small in quantity, or even totally wanting, at the indentations which correspond to the bends of the knot; if the latter is undone, its former situation remains distinctly visible, and the individual curves persist. Knots on the other hand which arose during labour can be easily undone, and afterwards leave no trace; nor does the original place show any diminution in jelly.

Knots arise by the twisted cord forming a loop through which the fœtus glides, or which is pushed over the whole length of the just delivered child, and drawn tight over it. If the loop lies in the lower segment of the uterus, it must be twisted in such a way that the fœtal portion passes away *under* the placental; if not, when the fœtus has passed through the loop, no knot is formed. If the fœtal end crosses the maternal twice, *i.e.* if the cord forms two loops coinciding with each other, a double knot is formed; similarly when an already formed loop is repeatedly twisted, or when the fœtus passes a second time through the single loop. If the fœtus passes through a double loop, one half may continue to lie on the other, or the two halves may separate from each other and come to lie in such a way that their vertices are at opposite ends and the knots form a figure of 8; of course in the latter case the "knotting" must be a loose one (Hyrtl).

Knots formed during labour have no importance to the fœtus, even those formed during pregnancy but very rarely affect the circulation[1], and probably only when they are drawn tight, and the cord is very thin (Billi speaks of the death of the fœtus produced in this way, or by the cord being coiled round its body, as "intra-uterine suicide").

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[1] According to Chantreuil only once in 1,000 cases.

3. *Coiling of the Cord round the Fœtus.*

§ 375. The cord is coiled round some part of the fœtus in about one out of every four births, possibly still oftener. As a rule no harm results, but this is not always so, especially when the coils are very numerous (Credé has met with a case where there were 8 coils, Gray one where there were 9). *At the time of labour* the relative shortness of the cord which is produced by the coils, may lead to anomalies in the presentation and position of the fœtus, to delay in the second stage, to premature detachment of the placenta, or to asphyxia and death through arrest of the circulation ; the latter is specially likely to occur when the cord is wound round the neck, and is squeezed for a considerable time against the symphysis, while the fœtus is making its exit. Hence it happens that on an average out of about 8 living children round which the cord is wound, we find one born in a state of asphyxia, and that the danger rises in proportion to the duration of labour after the rupture of the membranes ; it is therefore greater in primiparæ, with male and with large children.

When the cord is coiled round the fœtus *during pregnancy*, the injurious influence is not so much (if at all) seen in obstructing the circulation as in constricting the encircled part; and practically we are merely concerned with the neck and limbs. A *sudden* arrest of the circulation is probably extremely rare, for the formation of the cord (Wharton's jelly) and the mobility of the fœtus act as safeguards. *Gradual* interruption is more frequent; for when the coils are very tight and do not relax with the growth of the encircled member, the loop becomes too tight for the latter; the neck or the extremities, as the case may be, are firmly ligatured, and on their part exert an obstructive action on the umbilical vessels, causing the fœtus to perish. In this case the part of the cord which is nearest to the placenta is almost always found to be swelled through infiltration of its texture and dilatation of the vein (Dohrn). If the twists round the limb form *very gradually* while the fœtus remains alive, the soft parts of the latter may be divided down to the bone, indeed even the bone may be indented. The insufficient supply of blood to the portion lying below the constriction, will then retard its further development; the distal part of the limb will shrivel and may be entirely detached by some slight cause, *e.g.* fœtal movements (self-mutilation). If the coils are wound round the neck, death must soon follow; the affected region of the neck may be reduced to extremely small dimensions, or be almost severed, as happened in the famous case of Hillairet[1] (*cf Monatsschrift f. Geb.*, x., p. 60).

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[1] *Cf. inter alios* Gery, *Centralblatt f. Gyn.*, 1877, p. 23.

It is very probable, although difficult to prove, that coils of the cord, more especially when wound round the neck, may prevent a fœtus at term from engaging in the brim in the vertex presentation, and thus cause the pelvic end to present.

4. *Torsion.*

§ 376. Excessive twisting of the cord round its axis so as to cause the portion concerned almost entirely to lose its jelly of Wharton, and the vessels in it to become almost or entirely obstructed, is most often seen in fœtuses of the second half of pregnancy. The seventh month is the favourite, but the malformation has been seen in fœtuses only three months old, as well as after the 8th and even at the 10th month.

The torsion is either of *ante-* or of *post-mortem* origin. In the former case it usually leads to the death of the fœtus, and the expulsion of the latter follows either soon, or, as is the more common, only after some time, occasionally after some months. Ante-mortem torsions are produced by the active movements of the fœtus or by exposure of the body of the mother to violent and prolonged shocks; they may probably also be produced by the movements of a second fœtus lying in the same amnion (Winckel). Post-mortem torsions can only be due to the fœtus being twisted in consequence of movements of the mother.

Torsion appears to be commoner in multiparæ than in primiparæ, as we should expect from the greater stability of the fœtal "lie" in the latter.

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[1] Hennig (*l.c.*) has found 70 cases recorded in which well established severe constriction, and consequent deformity of the fœtus were due to the cord being repeatedly coiled round it.

According to most observers, boys are more often affected than girls. [Thus in Martelleur's statistics, there are 37 male fœtuses to 25 female; if to these I add the 15 cases of Winckel, consisting of 10 boys and 5 girls, we obtain a proportion of 47 male to 30 female fœtuses=157 : 100. Billi's large collection shows the proportion of males to females to be as 13 : 9.]

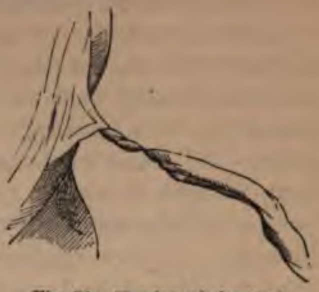

Fig. 72.—Torsion of the cord. (Blume.)

The length of the cord generally corresponds to that of the body of the fœtus, but not rarely exceeds it. Of course great length favours the occurrence of torsion, since the shorter cords are more taut than the longer, and after being twisted, more readily unwind themselves. On the other hand it is undue twisting of a short cord which is most injurious, since such a cord can be dangerously twisted in a very short time. The number of spiral turns in the cord is usually very large, and this is in a measure the first step towards torsion; in rare cases however the cord has been found to possess but few or even no spiral turns. The twists, as we should expect from their mode of origin, are as a rule close to the umbilicus (figs. 72 and 73), very rarely at the placental or at both ends; sometimes well marked twists are at the same time found in the middle of the cord.

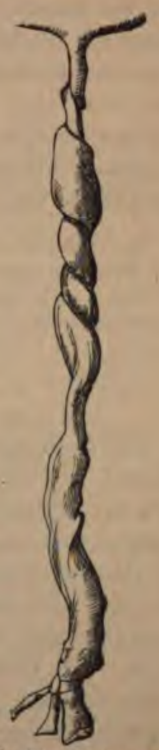

Fig. 73.—Torsion at the fœtal end.

The reason for the twists being so frequently situated at the umbilical extremity, is to be found firstly, in the poverty of jelly so often seen at this spot, and in the greater ease with which the cord can therefore be twisted, and further in the fact that although of the two attached parts of the cord, that which lies nearest to the fœtus (*i.e.* to the active agent in causing the twists), must be the first to suffer from the rotation, yet when the whole cord is of considerable thickness the twists which start from the fœtal body, will readily pass away over the cord and produce their effect at the other fixed portion, viz. the placental end. The navel is usually somewhat dragged out in the form of a pouch ; so also is sometimes the abdominal skin, much as the amniotic lining of the placenta is drawn out, when the twists are at the placental extremity.

Complete occlusion of vessels is rare, and only occurs when the torsion is very considerable ; for the most part they remain pervious, although narrowed to a considerable extent, or else one vessel only is impervious. Sometimes thrombi of varying consistence are found in them, and this indicates that the torsion was of rapid formation. Secondary œdema of the adjacent portions of Wharton's jelly frequently accompanies the abnormal twisting. Another moderately constant post-mortem appearance is blood-stained serum in the abdominal and pleural cavities ; Billi states (*cf.* Hecker, *Klinik*, ii., 1864, p. 29) that on two occasions he found the cerebellum smaller and softer than the cerebrum, and he seeks to explain the excessive fœtal movements as arising from disease of the brain. A case in which the cord was completely twisted off is mentioned by Hirsch (*Monatsschrift f. Geb.*, xxvi., p. 333) ; but it is not certain whether this occurred during pregnancy or only during labour (it affected the first of twins).

The recurrence of torsion (and of the consequent death of the fœtus?) in subsequent pregnancies is curious. The lying-in hospital at Halle (*cf.* Fritsch, *Klinik d. Geb. Operationen*, 1875, p. 353) contains a preparation taken from a woman who aborted 7 times, one after the other, for that reason.

5. *Stenoses.*

§ 377. Simple stenoses of the umbilical vessels, *i.e.* unconnected with torsion, have been described in the case of the arteries (Späth), as due to atheromatous changes. Hyrtl has figured some cases in which the umbilical vein was constricted at its insertion into the placenta by new connective tissue, which formed wide bands running along the vein, *i.e.* by a kind of periphlebitis, which however does not interfere with the circulation. But Oedmanson (*Arch. f. Gyn.*, i., p. 523) and Winckel were the first to mention and accurately describe the *contractions of the lumen of the vein in the course of the cord*, which are usually situated in the neighbourhood of its placental end, originate from the actual wall of the vessel (intima and muscularis) and are extremely deleterious to the life of the fœtus. According to the investigations of Birch-Hirschfeld, they are caused by a very localised hyperplasia of the intima, consisting partly of fusiform, partly of round cells, which are probably succeeded by a more fibrous tissue, or a granular ground substance with oval and round nuclei; although the process starts in the intima, the adventitia finally also becomes implicated by an abundant accumulation of lymphoid elements. The last-named author has also in a few cases found similar localised disease in the intima of the arteries; and he regards all these processes as due to inherited syphilis, owing to their microscopical resemblance to the changes described by Heubner as syphilis of the cerebral arteries, which is the view the two observers first mentioned, and especially Oedmanson (although not so absolutely), have also adopted. Whether this view is trustworthy or not, is doubtful; Leopold (*Arch. f. Gyn.*, viii., p. 226) has described a case in which the death was due to this cause, but in which syphilis was decidedly not present.

The numerous other irregularities of the vessels as regards distribution, form and size are of no practical importance. Hyrtl has carefully described them in detail.

6. *Other Anomalies.*

§ 378. The umbilical cord may adhere to the fœtus by means of amniotic bands (*cf.* § 351), just as it may to the peripheral and placental amnion (*cf.* illustrations in Hohl's *Geburtshülfe*).

Cysts have occasionally been found in the cord within the amniotic sheath, and they are either to be looked upon as cavities due to liquefaction of the gelatinous tissue and to the neighbouring parts being pushed aside in consequence, or, if they possess a lining of epithelium, as remnants of the former allantoic sac whose epithelial layers were kept apart by an unusually copious collection of fluid between them. Ahlfeld relates an instance of *calcareous deposits* in the cord of a syphilitic fœtus (*Arch. f. Gyn.*, iii., p. 311).

Local bulging of Wharton's jelly and of the amniotic sheath has been repeatedly observed. Ahlfeld (*Arch.*, xiii., p. 164) has also described nodelike structures lying in the amniotic connective tissue and projecting into the jelly; they consisted of closely aggregated, round cells.

7. *Hernia of the Cord.*

§ 379. Lastly, we must say a few words about hernia of the umbilical cord (hernia funiculi umbilicalis), although it properly belongs to fœtal malformations. By this term is meant a protrusion of the viscera from the abdominal cavity at the point of insertion of the cord. The hernia is due to an arrest of development during the first period of embryonic life, and arises from adhesions of the amnion to the viscera not allowing the abdominal cavity to close completely, and (still more often) from the intestine, which at first lies outside the navel, being prevented from passing back, through a persistence of the vitello-intestinal duct[1].

The hernial sac is generally formed of amnion and peritoneum, the skin terminating sharply at the hernial orifice; sometimes however a thin layer of the cutis and even some strands of the abdominal muscles are continued on to the sac. The abdominal walls may be perfectly well formed, and merely appear as if forced apart by the rupture; or else there may be an actual deficiency of musculature, the rupture being continuous with the abdominal cleft. Hence the rupture will vary in size and form. The umbilical cord is not always inserted at the same point; it is most often below, sometimes at the end, and in very rare cases above the hernia. The vessels of the cord may be present in the usual way, but one artery is often missing, an occurrence which may be explained on purely mechanical grounds, viz. by the pressure which the contents of the hernia exert on its sac. The vessels on reaching the point of insertion of the cord into the hernia diverge, and continue their course between amnion and peritoneum. The contents of the sac consist of coils of intestine, or a varying part of the liver; even stomach, spleen and kidneys may be protruded, in which case almost nothing remains in the (usually small) abdominal cavity; when the sac contains the liver, its neck is frequently a broad one, and the hernia can be returned. Adhesions between the sac and the contained viscera are not uncommon, and are due to the latter irritating the walls of the former. For the same reasons adhesions of the liver are commoner than those of the intestines.

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[1] This view of the ætiology is maintained by Ahlfeld, and confirmed by observations made at Marburg (*cf. Centralblatt f. Gyn.*, 1878, pp. 260, 261).

Hernia of the cord may occasionally be found uncomplicated by other anomalies, *i.e.* in an otherwise well formed fœtus; but as a rule other malformations co-exist, especially in the limbs and generative organs. Such cases are to be explained by the traction which the prolapsed viscera exert on the neighbouring parts, and, as would be expected, the organs which lie nearest to the abdomen are most frequently involved. Anomalies of the intestines, stricture of the lower portion of the bowel and atresia ani, or the formation of a cloaca are most often in causal connection with the protruded ectopic coils of intestine.

h. Anomalies of the Fœtus.

§ 380. The pathology of the fœtus includes errors of development, *i.e. malformations, constitutional and local diseases,* much as they occur in extra-uterine existence; and *intra-uterine death.* For a description of the malformations, I must refer the reader to the monographs which treat of them, especially to that of Förster (*Die Missbildungen des Menschen,* with atlas, Jena, 1861), and to the recent great work by Ahlfeld (*Missbildungen,* Leipzig, 1880); also to the text books of pathological anatomy; their relation to obstetrics will be discussed under "Pathology of Labour." Here we can briefly describe only a few accidental anomalies, especially of the extremities, since they are caused by the mechanical relations of the fœtus to its membranes. I must adopt a similar course for the actual diseases of the fœtus. Further descriptions will be found in the works just mentioned, and in manuals of children's diseases. The share which diseases of various organs and cavities have in producing difficult labour, will be dealt with later on. The transmission of infectious diseases to the fœtus has already been discussed (§ 257 *et seq.*); here therefore we shall briefly mention only a few additional affections, owing to their practical importance.

1. *Intra-uterine Fractures.*

§ 381. Most of the fractures of bones of the skull or limbs, which are sometimes found in new-born children, have been produced *during labour*. They may be due to operative interference, and cannot always be avoided even by the most skilful; or they may occur in the ordinary course of labour owing to the expelling forces endeavouring to drive the head into a contracted pelvis, and to the consequent displacement and flattening of the bones. Both these varieties of fracture will again be referred to under "Contracted Pelvis," and in the part devoted to "Operations." Fractures of the skull have also been met with in cases where the pelvis was roomy, and are easily explicable by the presence of some bony growth or exostosis either in the pelvis or connected with the lowest lumbar vertebræ, as has actually been observed. We must also admit the possibility of limbs being fractured by the *mere force of the pains*, if we remember the occasional impaction of limbs between the pelvis and the head or trunk, as may occur when the attitude is abnormal; such fractures have actually been seen, and the features of each case will probably explain the accident.

Breaks in the continuity of a bone produced *previous to birth*, may depend on insufficient ossification, or on imperfect union of the deposits of bony substance which form round the various centres of ossification, as is known to occur in some instances, especially in the case of the cranial bones; or on separation of the epiphyses through inflammatory processes or on the union with the diaphyses taking place in an abnormal manner, as is particularly common in syphilis; also on congenital rickets; or else they are due to some external *force* applied to the abdomen of the pregnant woman. In these cases the latter may not present any sign of external injury, just as in adults the gravest internal injuries may occur after contusion and shock, without there being any distinct, or at any rate marked, signs of it externally. Such an intra-uterine fracture will be all the more likely to occur, if there existed at the same time imperfect ossification, or if there was but little liquor amnii to break the shock. The fracture almost always affects the limbs, most often the leg, probably because it lies in the most exposed position in the uterus; the skull is better protected by its spherical form and its position in the great pelvis or at the entrance to the small one[1]. The actual displacement which is observed in almost all fractured limbs, is due to the muscular traction which was at work, while the fracture was undergoing consolidation.

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[1] But that such fractures of the skull may occur, is shown *inter alios* by Oller's case (*Centralblatt f. Gyn.*, 1878, p. 238).

Whether well developed bones may be injured in the uterus without any evidence of external violence is doubtful; the recorded cases are very improbable. It is possible however that injury might arise by persistent pressure of the head or any other part against a projection of the vertebral column.

The prognosis for fractures of the extremities is not bad in itself; they generally heal rapidly, unless gangrene due to complications sets in. Occasionally however as the child grows up, evil effects show themselves in the form of paresis and atrophy, resulting from the nerve cords having been stretched at the time of the fracture, or from the inflammation of the bones ending in atrophy or sclerosis. Fractures of the skull on the other hand are generally fatal owing to the concussion, laceration and hæmorrhage of the brain which almost always accompany them; if however the latter injuries are absent, the child may survive the actual lesion without damage; but whether without bad consequences in the future is doubtful.

2. *Curvatures and Dislocations.*

§ 382. When individual parts are misshapen, bent and twisted, or when the whole fœtus is compressed, the cause may be that the space in which it lies has been diminished, either by extra- or intra-uterine pressure. It may therefore depend on uterine or peri-uterine tumours, on diminution of the abdominal cavity from spinal curvature, on an insufficient quantity of liquor amnii after a part has been prematurely discharged, or lastly on too tight clothing, or on some occupation which necessitates a prolonged stooping posture.

Hohl has recorded a number of such cases in his *Lehrbuch*, 2nd Ed., p. 367. *Cf.* also Conrad, "Zur Actiolog. der congenit. Gelenkdeformit." *Correspondenzblatt f. Schweiz. Aerzte*, v., 1875, No. 6.

§ 383. The *causation* of intra-uterine dislocations is obscure. Some may be produced by injuries affecting the uterus and fœtus of a woman advanced in pregnancy, but most are to be referred to anomalous development of the articular cavities, which for unknown reasons are not formed primarily at the usual situation, but somewhere else on the ilium. It is curious that the greatest number of such cases occur in female fœtuses, possibly because (*cf.* Fehling, *Arch. f. Gyn.*, x., p. 46) the iliac alæ take a more vertical course in that sex?

3. *Intra-uterine Detachment of Limbs.*

§ 384. The detachment of limbs *in utero*, *spontaneous amputation*, which was even as late as the time of Chaussier and Billard looked upon as a consequence of gangrene of the affected limb, mainly arises, as was first clearly shown by Montgomery, through the limb being constricted by amniotic bands (and in such cases other malformations due to the same cause frequently co-exist) or by a loop of the umbilical cord; either of these constricting agents at last leads to detachment of the affected segment (*cf.* §§ 351 and 375), partly owing to the gradual shrinking of the bands, partly owing to the growth of the encircled segment, while the aperture through which it passes remains of the same size. Sometimes the fracture of a bone is the cause, especially since the fractures mainly occur during the later half of pregnancy, *i.e.* at a time when owing to the great activity of the fœtus the conditions are not very favourable for the union of the fracture; in such a case it is not uncommon for the vessels and the skin to be divided, and for an inflammatory demarcation line to be produced. Inflammation of the skin and deeper parts may likewise at an early stage interfere with development by means of cicatricial contraction; but such a case is not properly one of true spontaneous amputation, although in external characters it may resemble it, but one of arrested development. Very frequently the member is not completely detached, but a deep furrow is found associated with atrophy of the peripheral portion; under such circumstances, a slight degree of violence will suffice to complete the separation. The detached portion is occasionally found in the amniotic sac; if not found, the detachment occurred at an early period, and the yet soft parts must have been broken up and dissolved in the liquor amnii; in the latter case the stump is found at birth to be cicatrised, while when the separation occurred later the cicatrisation may be incomplete.

The hands and feet, above all the fingers and toes, are most often found deformed in this fashion, at any rate this is true of the cases in which abnormal bands produced the amputation; next come the leg, fore-arm, upper arm (especially of the left side), and thigh, with decreasing frequency. The curious fact was observed by Simpson that a slight rudimentary regeneration of the lost member may occur on the amputation stump; but this only extends to the construction of nails and of small projections consisting of hypertrophied cicatricial and fleshy connective tissue (fig. 74).

4. *Rachitis.*

§ 385. Since the bones grow *in utero* according to the same laws as during extra-uterine life, and are therefore subject to the same hindrances to development and to ossification, no *a priori* objection can be made to the occurrence of *intra-uterine rickets*, and as a matter of fact a number of cases have been described in which the changes found in the fœtal skeleton appeared identical with those seen in the rickets of children. In other cases, although the external habitus was the same, careful examination revealed considerable differences.

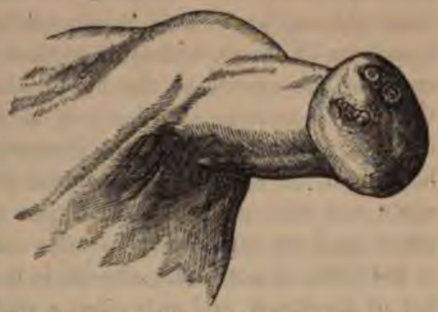

Fig. 74.—Amputation of the left fore-arm, with rudimentary formation of fingers. (Simpson's *Obstetric Works*, edited by Priestley and Storer, ii., p. 377.)

This habitus, which is much the same in all cases, is characterised by an unsightly plumpness, a large trunk, and above all a voluminous abdomen, a big, frequently even hydrocephalic, head, and thick, short, curved limbs. The skin is thick, rich in fat and often hangs loosely round the body, as if the latter had too large a covering, making it necessary for this covering to be thrown into folds; this appearance is specially noticeable in the limbs, owing to the deep constrictions that they present. The abdominal viscera, especially the liver, are large.

The alterations in the skeleton almost exactly correspond to those of post-natal rachitis; the diaphyses of the extremities are thick, short, curved, often fractured, while the epiphyses are soft, swelled, and entirely cartilaginous. The same is true

§ 387. True rachitis, according to Winkler, shows itself in two forms, *rachitis micromelica and r. annulans.* The former is characterised by great shortening of the limbs and by thick diaphyses, and results from the fœtal variety, *i.e.* rickets which has run its course in the uterus; r. annulans on the other hand, "rachitis with rings of bone and multiple fractures," is the disease which has originated late and continues in progress at birth, and is an intra-uterine affection continued during extra-uterine existence. Inasmuch as congenital rickets may afterwards lead to r. micromelica, while the latter may be due to non-rachitic processes, the practical value of this subdivision into varieties is open to question.

The causes of rickets, as of other similar diseases of bone, are unknown. We may be sure that it does not depend on mere malnutrition of the mother; this is shown by the rarity of the fœtal affection, and by the fact that one twin may be diseased, while the other is healthy (Klein). There is more reason for thinking that disease of the placenta may lead to irregularity in the ossifying processes, especially as in the case of twins just referred to, the placentæ were divided, while in another case where both fœtuses were diseased (Romberg), there was a common placenta; moreover hydramnios has more than once been seen where the fœtuses were affected. The hydramnios however must be looked upon as secondary to the disease of the fœtus, and we have no knowledge whatever as to the nature of the placental disorder in question.

5. *Goître.*

§ 388. Temporary swellings of the thyroid, due to disturbance of the circulation during labour, are sometimes seen in face presentations, and under such circumstances can easily be explained. They have no special significance. It is otherwise with the true *intra-uterine* or *congenital goître.* This is one of the rarer fœtal diseases, probably always depends on simple parenchymatous hyperplasia, and is permanent. It occurs mainly under favourable endemic conditions, with or without hereditary predisposition; in sporadic cases, the inherited predisposition is rarely absent. Congenital goître may give rise to a face or brow presentation, by making the flexion of the head, which is necessary for vertex presentations, impossible (*cf.* § 174); to the cases published by Hecker and Simpson illustrating this point, Löhlein has added another in *Zeitschrift f. Geburtshülfe*, i., p. 24. But it is a more important fact that goitre may, even after extra-uterine life has commenced, lead to great difficulty of respiration, and even to death by compression of the windpipe; this asthma thyroideum was very severe in two cases under my care, and in one described by Hecker (*Monatsschrift f. Geb.*, xxxi., p. 199).

6. *Syphilis.*

§ 389. In order to complete what has been said in § 267 (transmission of syphilis to the fœtus) and §§ 372 and 377 (syphilis of the placenta and the cord), we must here describe the changes produced by syphilis in the fœtus. They are found in its skin, thymus, lungs, liver, spleen, supra-renals, pancreas and intestine, on its serous membranes and in its bones; they are most constant in the latter and in the spleen. It must however be noticed that almost all of them are only found in a well marked form, in fœtuses that have died shortly before, or soon after, labour either premature or at the full time; since when death occurs *in utero* at a very early date, they have not yet become fully developed, and even in the cases of death at a later period the maceration which generally ensues, obliterates a large part of them; all the more importance therefore attaches to the characters seen in fœtuses which have been very recently or but little affected by such maceration. Even in a fresh and highly diseased fœtus, the whole of the organs mentioned will of course not be attacked at the same time.

§ 390. The *skin* frequently presents numerous ecchymoses, and occasionally some induration of the subcutaneous cellular tissue is observed. But it is the formation of vesicles, pemphigus syphiliticus, varicella syphil. confluens (Zeissl) at various stages of development, that, although somewhat rare, is most important. The vesicles are usually large, thin-walled, with more or less purulent or blood-stained contents, and are surrounded by a red areola. They are chiefly placed on the volar surface of the hands and feet, on the fingers and toes, although they may also be seen on other parts of the body. If the vesicles are confluent, the corium is exposed in large patches, and sometimes, even with a living child, large flakes of skin can be drawn off from hands and feet. *Such a condition may during labour simulate maceration.* In some cases the epidermis forms scabs.

The *mucous membrane* of the mouth, nose, pharynx and air passages shows small dark spots and rhagades, sometimes in a state of suppuration; gaps in the soft palate may thus be produced, and the vocal cords may be entirely or partially destroyed.

On the *serous membranes*, as on the skin, numerous hæmorrhagic spots are found, while in addition a serous blood-stained fluid is poured out into the cavities. The peritoneal cavity is especially apt to be affected in this manner, and the *hydrops sanguinolentus* of that cavity has actually been described as characteristic of syphilis (Martin). Such however is not the case, for the same condition is seen in a large number of still-born fœtuses which were certainly not suffering from syphilis, and it must be regarded as a result of maceration and of the disintegration of red blood-corpuscles. Nor must it always be looked upon as a result of *peritonitis*. The latter is one of the rarest affections, and in it the exudation is sometimes found still fresh, sometimes already dried and shrunk. Its connection with syphilis has been specially insisted on by Simpson, and its cause probably lies in disease of the great abdominal viscera, although not necessarily in the liver, as Gubler believed.

When the *thymus* is diseased, which is not often, it is usually enlarged and contains a number of for the most part only small abscess cavities, distended with pus and lined with smooth walls (Dubois), characters which can scarcely be confused with those of the ordinary, sometimes slightly altered, fluid contents of the thymus.

§ 391. The changes in the lungs and in the great organs of the abdominal cavity, are more common and important. They generally lead to the formation of gummatous nodules, *i.e.* cellular new formations destined to undergo retrograde changes, much like those found in the visceral syphilis of adults, and it is these retrogressive changes which, if not fatal to the fœtus while still *in utero*, cause its death some days or weeks after birth.

In the *lungs* numerous nodules are found of the size of peas, separated from the surrounding tissue by a highly vascular areola, and distinguishable from that tissue by their paler colour. At first they are reddish-grey, afterwards yellowish; then they soften and become filled with caseous pus. In more advanced cases they are replaced by indurated cicatrices. Or else instead of these multiple nodules scattered through the whole lung, merely a few syphilitic deposits may be found lying here and there under the pleura, of firmer texture and in rare cases having undergone degeneration at their centres. At other times in addition to or without such nodules, the lungs are found to be more voluminous, heavy and dense than usual, containing air in parts, if the child has breathed, and of a bright- or yellowish-red colour on section. This variety is due to an interstitial diffuse infiltration (white hepatisation, white induration).

The *liver* is considerably enlarged, so that it can usually be felt even before the abdominal cavity is opened, projecting to a varying extent towards the left side beyond the umbilicus; it may be as much as three times as heavy as normal, of firm consistence and a flintlike colour on section, the usual markings having disappeared. Abundant cellular proliferations in the walls of the bile-ducts and of the vessels, as well as round them, push the normal hepatic parenchyma aside, and together with the compressed bile-ducts become transformed into dense bands of connective tissue, which often traverse the enlarged organ in great bundles. Moreover small whitish nodules are found scattered copiously over the cut surface, or else there are somewhat larger darker nodules lying more superficially, projecting from the surface of the liver, and there indicated by brown spots; they are aggregations of cells which will afterwards degenerate, if that process has not already begun in their interior. Occasionally if the child has lived longer than usual, those larger nodules may be found converted into cicatrices.

The affections of the *pancreas*, although not at all rare, probably belong to the last months of fœtal development and are entirely analogous to other interstitial changes, especially those of the liver. It consists in interstitial growth and induration, causing the organ to be generally enlarged, heavier and firmer. A section of it is white and shiny, but the division into acini is no longer visible to the naked eye, since the new growth not only affects the tissue between the larger lobes of the gland, but in severe cases that between the individual lobules of the former, compressing them, causing atrophy of their epithelium, thickening of the walls of the vessels, and obliteration of the capillaries.

Enlargement of the spleen is one of the most common occurrences and all the more important, as it may almost invariably be recognised even in fœtuses that have undergone extensive maceration. Special disease of the splenic tissue cannot as a rule be made out, and although an increase of the stroma or even amyloid degeneration is sometimes met with, it has no specific value; no pathological deposits have been seen. If the fœtus has not undergone putrefaction, the enlarged and relatively very heavy organ will be compact, have a tense capsule, and present a waxy appearance on section.

The *supra-renals* are not very often diseased; but in such a case they also are enlarged, dense, hard and difficult to incise, the cut surface being poor in blood and shiny. In the cortical substance are sometimes found the whitish nodules which have already been mentioned more than once, and also caseous deposits. We have recently seen similar nodules in the *intestine*.

§ 392. When the *bones are diseased*, those of the *skull* usually escape; when they do not, the internal surface escapes more often than the external; I have only once found a gummatous nodule on the right parietal bone[1]. On the other hand we almost invariably (Wegner, who first pointed out this fact, says invariably) find changes in the *tubular bones*. These generally exhibit an increased hardness and density both in the cancellous tissue of the epiphyses, and in the compact tissue of the diaphyses; the consistence however may be normal or even diminished. But disease always exists at the point at which the diaphysial bone passes into the epiphysial cartilage, which disease may show itself in three forms, although all three are merely transitional stages of one and the same process, viz. of an *osteo-chondritis*. This morbid process begins with an excessive proliferation of the cartilage cells at the margin of the epiphysis, which is rapidly followed by an irregular calcareous infiltration and sclerosis of the newly formed tissue. Later on, the same tissue becomes transformed into a true osteoid substance, without the necessary formation of new vessels progressing at an equal rate; thus is laid the foundation of the rapidly retrogressive metamorphosis of the new material. The cells enclosed in the osteoid ground substance undergo granular or fatty degeneration, which is soon followed by inflammatory processes which lead to a demarcation on either side, and may end in complete detachment of the epiphysis.

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[1] Parrot (*cf.* also the *Bulletin génér. Thérap.* for April, 1879) on the other hand states that the formation of osteophytes in the shape of plates is one of the most constant occurrences, these plates being found for some months after birth on the surface of the skull, more particularly on the frontal side of the parietal and on the frontal bones. Parrot believes that they grow gradually, disturb the symmetry of the skull, and give it a characteristic appearance.

In the first stage, there is seen at the boundary of cartilage and bone a brilliant reddish-white layer, which is sometimes as much as 2 mm. (ca. ·1 in.) wide, and is bounded by a straight or sinuous line; this layer represents the zone which is the seat of preliminary calcareous infiltration and of proliferated cartilage cells. In the second stage, that zone becomes wider, the boundary line irregular, and nipple-shaped projections run towards the articular surface of the cartilage, which projections owe their origin to closely placed rows of cartilaginous cells, to a premature sclerosis following the course of the vessels, and to a calcification of the intercellular substance; as regards the cancellated osseous material nothing more than a delay in the conversion of cartilage into bone is observed. In the third stage, the articular ends are enlarged, the perichondrium and periosteum are thickened on their external surface; the lowest layer of the cartilage is of a bluish and transparent appearance, and is succeeded by a yellowish-grey layer 2—3 mm. (ca. ·1 in.) broad, which is gradually lost in the substance of the diaphysis. In this position an actual caseation is found within the calcified ground substance, while in the yellowish portions of the layer a granulation tissue is undergoing more or less destruction by suppuration. By the interposition of this soft layer, the coherence between epiphysis and diaphysis is loosened, and, as already mentioned, one or more of the epiphyses may be spontaneously detached.

The various bones of the skeleton are by no means equally affected in the same individual; the lowest end of the femur generally shows the most marked changes, then come the lower epiphyses of the tibiæ and bones of the fore-arm, then the upper epiphysis of the tibia, next that of the femur and of the fibula. After a considerable interval follows the upper end of the humerus, then that of the radius and ulna, finally the lower end of the humerus; a sequence which almost exactly coincides with that mentioned in regard to rickets, and also with the breadth which the layer of cartilaginous proliferation possesses at the various points, when ossification is proceeding in a normal manner.

This disease is of great importance, not only owing to its constancy, but also for diagnosis, since it undergoes relatively few changes in even a considerable time after intra-uterine death, and for that reason is of great help in enabling us to diagnose syphilis in macerated fœtuses. Whether the syphilitic affections of bones belong to the earliest signs of fœtal syphilis, can hardly yet be decided, but at any rate when the fœtus is not fully developed, only the first stage is met with. It is chiefly to be looked upon as a legacy of inveterate paternal syphilis.

Apart from this osteo-chondritis, Wegner states that a further change sometimes occurs in the medulla of tubular bones, a change which may be diffuse, but generally starts in isolated deposits. The medullary substance presents a yellowish-red colour, and microscopically an extensive fatty degeneration of the medullary cells and the walls of the vessels.

§ 393. I must also draw attention to the not very uncommon association of *hæmorrhages* of the skin and the internal organs with syphilis. These hæmorrhages probably depend on the changes (which can also be seen with the microscope) in the small arterial twigs running in the tissue; and we know that, generally speaking, the vessels seem easily to be affected by the syphilitic virus.

Nor must I omit to mention Bärensprung's view that the syphilis which is confined to the lungs is more or less exclusively met with, where the disease has been derived from the mother, while when derived from the father, the liver, supra-renals, spleen, and peritoneum are the organs of election, a view which can in several ways be shown to be erroneous (Rosen, Hecker).

Intra-uterine Death.

§ 394. The various morbid conditions which may lead to death of the fœtus during pregnancy, as well as the manner in which they exert this influence, have been sufficiently described in the previous section. I have here therefore merely to recapitulate that the death of the fœtus may be due to:

a. The direct transmission of a virus or a dyscrasia, either acute or chronic, from mother or father to ovum (acute infectious diseases of the mother, syphilis of the father, lead or other kind of poisoning of the mother); or

b. A rise of temperature in infectious or non-infectious febrile diseases of the mother; or

c. An inadequate supply of nutritive material, dependent upon mal-nutrition (anæmia) of the mother; or

d. To disease of the fœtal appendages (membranes, placenta, cord), due of course in many cases to disease in the parents; and finally

e. To external, *e.g.* traumatic, causes, which either kill the fœtus directly, or do so indirectly by causing the decidua and placenta to be detached or broken down by effusions of blood.

§ 395. Instances are not very rare in which intra-uterine death recurs in several successive pregnancies at, or nearly at, the same period of gestation, and without external provocation; this is known as *habitual death* of the fœtus, and is not exactly identical with habitual premature labour or abortion, although sometimes confused with them. This fatal event in many cases occurs very early as "recurrent internal abortion," although sometimes not till the later months, when it shows a preference for the 6—7th month, and again for the last fortnight.

It depends (*a*) in the great majority of cases on syphilis of the father, and when this is the cause, death rarely recurs in the same months, as would be expected from the varying rate of progress with which organs are affected in inherited syphilis. (*b*) In some cases maternal cachexiæ, particularly extreme anæmia (owing to which the fœtus does not receive enough nourishment), lead to gradual inanition, and finally to death of the fœtus; it is possible however that such maternal conditions cause the death of the fœtus indirectly, by the alterations which they produce in its membranes. (*c*) The rarest causes of habitual death are doubtless chronic affections of the inner surface of the uterus, of the decidua and placenta. They are more apt to lead to the repeated interruption of the pregnancy, than to produce *primary death* of the fœtus. The latter result however is possible, inasmuch as the diseased maternal "soil" is not congenial to the developing ovum. Moreover it is probable, although not quite certain, that there are independent affections of the fœtal appendages, *i.e.* unassociated with constitutional diseases of the mother (*e.g.* stenoses of the umbilical vessels), which may cause death in successive pregnancies.

Since the causes of habitual death of the fœtus are accessible to *treatment*, the malady itself must be so. These causes however must be got rid of before a fresh pregnancy begins, although even if they continue to act after conception, an attempt may be made to render them inoperative; but success will be rare. The means to be employed depend on general therapeutical principles. On the other hand the *induction of premature labour* before the date at which experience leads us to expect the death of the fœtus, is useless, if such death depends on infection or organic disease of the fœtus. Such an operation can only be admissible: 1, in the rare cases in which anæmia of the mother causes the death of the fœtus at an advanced period of pregnancy; in this case the fœtus might after birth be brought into more favourable conditions as regards nutrition; 2, perhaps in those uterine affections which are prejudicial in the two last months, and perhaps also where anomalies of the cord gradually cause the fœtus to perish. But these last-mentioned ætiological influences are as yet much too indefinite, and their *modus operandi* is too obscure, for us to lay down definite indications. At all events we can only hope for success from the induction of premature labour, where the autopsy of the previous fœtuses showed that they were healthy.

There are some curious cases in which a more or less regular alternation occurs in the birth not only of dead and living fœtuses, but even of viable and non-viable children; Hohl for instance records such instances, and it is possible that this alternation depends on the sex of the fœtus, one sex alone reaching maturity and remaining alive.

§ 396. The *signs* of the death of the fœtus were dealt with in § 137. The next *event* is as a rule the expulsion of the ovum; the arrest of the development of the ovum leads to retrogression of all the processes connected with it; the circulation in the placenta ceases, the placental and a portion of the uterine vascular channels become thrombosed, and parturition takes place. This almost always occurs within a short period after the death of the fœtus, a period varying from a few days to three weeks; only in rare cases (the more rarely, the later death took place) does the fœtus or the ovum remain for longer, *e.g.* for months, in the uterus, and this is most common, if the dead embryo is one of twins (*cf.* § 204); but even single fœtuses have been observed to remain in the uterus up to, and even beyond, the usual end of pregnancy.

§ 397. *The dead fœtus either undergoes maceration, or shrivels up.* Putrefaction of course is impossible as long as the fœtal cavity remains closed, and air is excluded. During the first 2—3 months of pregnancy when the embryo merely consists of a mass of cells, it is broken up into its elements by the maceration and completely dissolved (aborted ovum, *cf.* § 343). When of larger size, the form of its body is preserved, and the various organs continue as parts of one mass. The component elements however of these organs undergo maceration, and are dissolved in the liquor amnii, the fluids of the tissues and in the blood-serum, which together with the broken down red corpuscles has exuded from the vessels (which therefore become empty). The epidermis is the first tissue to undergo maceration, and does so very rapidly, forming large blebs, and where still adherent it can easily be stripped or rubbed off with the hand. The subjacent corium swells and turns reddish-brown by imbibing the pigments of the blood. The deeper tissues grow soft, flabby, discoloured and infiltrated with hæmatin. An exuded blood-stained fluid accumulates in the serous cavities, and the abdominal cavity especially is often greatly distended by it; indeed the softened abdominal walls may burst in consequence. The brain is rapidly converted into a reddish-grey pulp whose elements can no longer be recognised; amongst the organs in the thoracic and abdominal cavities the liver shows most alteration; the lungs and muscles, smooth as well as striped, remaining longest unchanged. But there is everywhere a granular cloudiness and obliteration of the histological elements, accompanied by a deposition of pigment and fat crystals in and around them. The crystals are sometimes so abundant that they form a greasy layer all round the organs (*lipoid* transformation—Buhl). The connections between the bones become friable, and at last give way spontaneously; those in the skull give way very early, so that even after a few days, the cranial bones may be free, movable one upon the other, and loose beneath the integuments. The latter are œdematous, especially in the most dependent portions, so that the head looks uncommonly large, sometimes as if it belonged to a monster. The whole corpse is changed in form under the influence of gravity and of external pressure (*e.g.* that exerted by the parts on which it rests), being flattened in some places, swelled in others. The *placenta* grows soft, rotten, and together with the vessels, bloodless. The *umbilical cord* is first of all discoloured, then infiltrated with blood, and in consequence of this, it at last turns reddish-brown; its fœtal extremity undergoes a thickening, which indeed begins suddenly at the edge of the capillary circle in the skin round the umbilicus; the whole cord loses its twists, becomes cylindrical, smooth and very friable; the vessels remain patulous. The *fœtal membranes* for a long time resist maceration, but at last they too become infiltrated, swollen and friable. The *liquor amnii* is rendered turbid by the detached epidermis, discharged meconium, and transuded blood-serum; turns greenish-brown in colour and possesses an offensive stale odour, like the whole fœtus; sometimes it is acrid and irritating to the skin.

These changes vary in their rate of progress, and it is possible by their means to estimate the time at which death took place; never exactly, but with some degree of approximation. It is easy to understand that the prolonged contiguity of the uterine wall with the macerated ovum, from which doubtless certain substances are taken up by the decidua and placenta, must be prejudicial to the health of the mother; but the fact that no true infection can take place explains why she is not very severely affected.

§ 398. When the fœtus has become *shrivelled or mummified*, it is dry, looks as if it had been tanned, or preserved for a considerable time in alcohol. The subcutaneous areolar tissue has disappeared, the skin lies close to the muscles, its colour is uniformly reddish-brown. In the serous cavities there are mere traces of a dark fluid, the viscera are small, and of soft consistence. The outlines of the body are preserved, except for the flattening which is so often present. Mummification sets in, when the fœtus dies slowly or succumbs to gradual inanition, partly because no fresh liquor amnii is secreted, while that already present tends to decrease, partly because the arrest of nutrition that sets in even during life, causes the amount of blood and intercellular fluids to diminish. Mummification is therefore chiefly found where death, especially premature death, is due to progressive stenosis of the umbilical vessels, and occurs all the more readily if the supply of blood is not suddenly arrested at the moment of death, as sometimes happens when only one of twins dies. For this reason mummified fœtuses are most often seen with twin ova (*cf.* p. 275, note).

§ 399. *The dead ovum may*, as already mentioned, *be retained for a long time in utero.* Such a case must in the first place be distinguished from one in which a twin fœtus which has died early during pregnancy is retained, while the other continues to develop; in these circumstances the dead twin is expelled in a mummified condition, when the living one is born either at the natural time or prematurely, and no great difficulty is found in explaining this condition (*cf.* § 204 &c.). It is not so easy to understand how it is that a *single ovum* is retained; but here also it is important to distinguish between the cases in which the whole *ovum is intact*, from those in which it continues *in utero after the rupture of the membranes*, *i.e.* after the discharge of the liquor amnii.

When the *former* happens, we have always to do with the early death and mummification of the fœtus. The general as well as some of the local signs of abortion will then set in, but they disappear after a while, probably because the placenta is unusually firmly connected with the uterus. Since the placenta continues to a certain extent to receive nutriment from the latter, and indeed may become remarkably enlarged, as the liquor amnii decreases and the fœtus shrivels, a condition of quiescence sets in, during which the ovum behaves, I might almost say, like a newly formed uterine mucous membrane. But in these cases *the retention is never prolonged beyond the normal termination of pregnancy;* when this is reached the irritation of the central nervous system which supervenes on the termination of the cycle of pregnancy brings on labour. The expelled ovum, or rather its appendages, may then appear comparatively well preserved, a fact which needs no special explanation.

§ 400. Those cases however in which *the dead fœtus remains in utero for a variable period, possibly even for years after the normal termination of pregnancy*, are totally distinct; and this event may not only occur where death takes place prematurely, but when it occurs at a late period or even during labour, —"*missed labour*" of Oldham. In these instances a parturient nisus sets in at the natural date; but it does not lead to the ordinary result, the "pains" pass by, and the uterus comes finally to enclose the fœtus much as it would do a new formation. We cannot say why the expulsive activity ceases without effecting its purpose; sometimes there may be great obstruction, as I have already mentioned in § 299 in describing carcinoma of the cervix uteri, and of which a case is recorded by Menzies (*cf.* under M'Clintock); at other times the cause may possibly be found in an abnormally firm connection of the ovum with the uterus, or possibly to some extent in anomalous degrees of irritability. At any rate it must be observed that in these cases of missed labour, as far as I am able to judge from the literature of the subject, *no liquor amnii is retained;* its discharge must therefore have been effected during the parturient activity, and when this result had been obtained quiescence ensued. The discharge of liquor amnii however must have taken place without any air entering into the uterine cavity at the time, for otherwise the fœtus would undergo putrefaction, and either be expelled at once and *in toto*, or gradually and piecemeal; or else it must have become already mummified at a previous date, since under such circumstances in spite of the access of air putrefaction sometimes remains absent. Moreover it is known that with a very limited rent in the membranes with narrow parturient passages, and when no digital examinations are made, air may not enter.

The retained fœtus shrivels, and by means of inflammatory processes becomes closely adherent to the uterine walls. But it is possible, even after a prolonged retention, for it to lead to fresh and severe irritation and suppuration within the uterus, and this may lead to disintegration of the fœtus by suppuration, a result which may even later be brought about by the admission of air during operative interference. In such a case the uterus expels the decomposed contents in larger or smaller portions, either directly or by abnormal channels, as in the case of extra-uterine pregnancy. In rare instances however the fœtus remains for an extraordinarily long time, or indeed altogether, in the uterus, and undergoes changes similar to those accompanying the formation of a lithopædion (*uterine lithopædion*). In animals (most often in sheep, most rarely in mares), retention of a more or less mature fœtus and the formation of a uterine lithopædion are by no means uncommon events (*cf.* Förster, *Specielle Path. Anat.*, 2nd Ed., 1863, p. 403; Fabbri, *Bull. delle Sc. med. Bologna*, 1866, Mazzio; Franck, *Thierärztliche Geburtshülfe*, 1876, p. 265).

§ 401. The retention of a dead fœtus is, generally speaking, not a very dangerous condition; even where the fœtus afterwards undergoes decomposition and suppuration, recovery usually takes place after its expulsion, although the patient may suffer very greatly during the process. The fact that in spite of this decomposition within the uterine cavity it is rare for severe symptoms of septic infection to appear, is to be explained by the uninterrupted and free exit for the products of decomposition which is rendered possible by the (in these cases) patulous uterine cervix, as well as by the internal wall of the uterus taking on a condition much like that of a granulating surface.

Cases in which the whole ovum is retained, may give rise to difficulties as regards *diagnosis*, inasmuch as when the fœtus dies early and the symptoms of pregnancy disappear, there may be some doubt as to whether the affected woman was actually pregnant, and further whether she is still so, *i.e.* whether the ovum may not have been expelled unnoticed. A very careful critical investigation of the individual case, both in the light of the history and of the physical signs, will determine the point. Again, when such an ovum is expelled, care must be taken not to fix the date of conception from the degree of development of the ovum; in so doing we might do mischief. All that can be definitely stated is how old the ovum was, when it perished.

Treatment must be purely expectant, as regards the first category of cases. But in those of "missed labour," the cervix should be properly dilated, and all fœtal remnants should be removed. This will not be more difficult than the removal of easily accessible intra-uterine new formations; when however there is a co-existing metritis or peritonitis, very great caution must be used, or it may be better not to attempt the dilatation. Such cases however should only be left without any interference at all, where the retained fœtus or its remnants appear to be entirely encapsuled (formation of lithopædion), and produce no ill effects.

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5. *Hæmorrhage from the Uterus—Premature Termination of Pregnancy.*

§ 402. Hæmorrhage from the generative organs of pregnant women may have its origin in the uterus, vagina or external generative organs. That derived from the latter two regions does not present any features calling for special notice; it depends on the spontaneous rupture of varices, or on rupture or injury caused by external violence, and must be treated according to the usual principles. I have already stated (§ 248) that it may be fatal, and this is confirmed by a case related by P. Müller (to the Phys. Med. Society at Würzburg, 1873) in which a moderately superficial tear took place between the clitoris and urethra, probably due to sexual excess and associated manipulations.

It is hæmorrhage from the uterus that alone concerns us here, and this variety almost always depends on a rupture of the tissues (and the vessels lying in them) which connect the ovum with the uterus; in rare cases it may be due to conditions which are not directly caused by the alterations associated with pregnancy, *e.g.* to new growths in the uterus or destructive processes affecting its lower segment. These latter causes have been already discussed in the 3rd chapter of this part, § 296 *et seq.*

Since the hæmorrhage that is peculiar to pregnancy depends on *detachment of the ovum, or at any rate on a more or less extensive destruction of its connections with the maternal tissues*, it is intimately connected with the *premature expulsion of the ovum*, *i.e.* with premature labour, whether as cause, symptom or effect. For owing to the deleterious influence which the hæmorrhage and the alterations causing it exert on the life of the fœtus, and owing also to the mechanical irritation which it produces, the detachment must lead to the expulsion of the fœtus; while when parturient activity sets in primarily, *i.e.* while the connection of the ovum with the uterus is still mechanically intact, it must produce a detachment and consequently hæmorrhage. The *description of hæmorrhage during pregnancy therefore corresponds with that of premature labour*, in the wide sense of the expression.

The ætiology and the *modus operandi* of both of these agents are the same throughout the whole of pregnancy. Nevertheless it is convenient for clinical purposes to distinguish hæmorrhage and labour occurring during the first 28 weeks, from those events in the next 3 months, partly because in the earlier months the connection of the ovum with the uterus differs from that in the later months, partly because the causes which produce detachment and premature labour in these different epochs are almost always very different, and partly in the last place because a fœtus expelled during the first 28 weeks, even if born alive, cannot be reared, as it can after reaching fuller maturity. It is therefore well to retain the distinction between premature expulsion occurring during the first 28 weeks and called *abortion*, from that happening at a later period, and called *premature labour* in the narrow sense, and to describe hæmorrhage during the first six months separately from that which supervenes later.

§ 403. But I must first of all say a word or two about the hæmorrhage which has been spoken of as *menstruation during pregnancy*. Leaving out of consideration the cases in which menstruation is said to have occurred once after conception, I have seen about 10 instances in which hæmorrhage occurred at intervals similar to those of menstruation; in six instances it recurred 2 or 3 times after conception had taken place, in two 4 times (up to the date of the first fœtal movements), once 5 times, and once it continued right on till labour, which took place about six weeks too soon. But all the patients referred to had, both in the non-gravid condition and in former pregnancies, suffered from previous uterine disorders, which in almost every case took the form of cervical or corporeal endometritis; some of them had already had premature labours, and during the subsequent pregnancies of several of the women the "menstruation" did not recur. Nor can the hæmorrhage which is met with during the first 4—6 weeks be looked upon as menstrual; such a view is contradicted by our present knowledge of menstruation, although the intimate connection of the reflexa and vera (which afterwards occurs) is not yet present, and therefore could not prevent it. The existence of ovulation during pregnancy—and I see no reason for not accepting Bischoff's views as to the connection of ovulation with menstruation—is hitherto totally unproved; while the changes which take place in the uterine mucous membrane during menstruation are absolutely incompatible with the uninterrupted progress of gestation.

The so-called *menstruations during pregnancy are therefore of the nature of pathological hæmorrhage*. When harmless, it is almost always derived from the diseased cervix (Whitehead, who has investigated a number of such cases of "menstruation" during pregnancy, says always); when the blood comes from the cavity of the body of the uterus, it is only harmless when the bleeding surface is very limited in extent; in other cases it must soon provoke premature labour and expulsion of the ovum through repeated detachment and destruction of the decidua; this view is also confirmed by our experience of the frequency with which women suffering in this way abort. It is principally the intermittent character of the hæmorrhage that has led to the assumption of its being menstrual. But no one has yet shown that the duration and periodicity of the hæmorrhage corresponded with the menstrual cycle in the individual affected, and even if the periodicity were perfectly natural, we should not be compelled to look upon the loss of blood as a true menstruation, since discharges of blood which depend on disease of the uterus may continue to be under the influence of the periodical excitement. And we see proof that this periodicity continues to make itself felt, in the circumstance that women inclined to abortion, are especially liable to it at such time at which, if they were not pregnant, the catamenia would have appeared.

a. Hæmorrhage during the first 28 *Weeks—Abortion.*

§ 404. The *causes* of abortion, both those leading primarily to hæmorrhage, and those which act by inducing uterine contractions, have been fully discussed in the four previous sections of this chapter; in regard to hæmorrhage I would particularly refer to §§ 342, 343. I need here therefore do no more than recapitulate the various causes, and arrange them so as to be seen at a glance. They are:

a. Primary disease of the fœtus.

b. Primary diseases of the fœtal membranes; both *a* and *b* may cause the death of the fœtus, *cf.* § 394.

c. Degenerative changes affecting the inner surface of the uterus, the decidua and the placenta; these changes generally lead to extravasation into the placenta, and the extravasation to abortion, although in rare cases they may directly lead to abortion by causing the death of the fœtus.

d. Diseases of the true uterine tissues, whether due to displacement or to structural changes, in consequence of which the organ is prevented from developing in the natural way, and is rendered liable to hæmorrhage into the decidua or placenta.

e. External causes which lead to uterine contractions or detachment of the ovum, or by which the integrity of the latter is directly destroyed (mechanical abortion).

f. Emotional disturbance and a prolonged condition of malnutrition of the mother may lead to death *in utero* (*cf.* cases of abortion in seasons of great destitution and terror); the former, as well as irritation of a distant part of the body, may by reflex action provoke premature expulsive contractions.

g. Lastly, we meet with instances in which absolutely no cause can be found, unless we content ourselves with a special irritability of the uterus or with an undemonstrated inherited predisposition. It is certainly not true that too young or too advanced an age is a cause; if abortion takes place in such women, it is due to disease of the reproductive apparatus.

Although in individual cases a knowledge of the immediate cause is of great importance as regards prophylaxis in a fresh pregnancy, such knowledge is often difficult to obtain; for one cause not infrequently calls others into operation, which then act in combination with the first. Indeed several factors may be at work from the very start, and the changes caused by them scarcely ever coincide with the expulsion of the ovum itself, but frequently originated long before, so that the latter may present the greatest differences. The decision is most difficult, when the dead embryo has remained for a long time in the uterus, and the placenta and membranes have undergone great alterations; it is easiest, when the cause is to be found in obvious changes of the adnexa or in syphilis, or when the abortion follows rapidly on the agent that produced it. In the latter case the membranes and placenta are almost always more or less well preserved and without material alteration; if they are torn, it may at once be concluded, at least in cases of abortion during the first months, that the cause has been mechanical and intentional.

Frequency and Time of Occurrence.

§ 405. Abortion is extremely common, certainly much commoner than would be supposed from the published statistics, for only in exceptional cases does an aborting woman call in medical assistance, or apply at a hospital or maternity. And how many abortions during the first 6—8 weeks escape the observation of both midwife and doctor; how often the patients themselves are unaware that they have aborted, and in how many cases the occurrence is intentionally concealed, because intentionally provoked! We are almost justified in asserting that there are not many women, especially of those who have been married for some time, who have not aborted at least once. Multiparæ, as would be expected, abort oftener than primiparæ.

If we except the abortions that occur during the first weeks, since for the reasons just given we are unable to pronounce any opinion as to their frequency, the majority of cases take place between the ninth and sixteenth weeks (according to Whitehead 422 out of 602 cases do so). The explanation of this is probably that the primary diseases of the embryo and its adnexa require a certain time to develop fully, that destructive changes in the decidua are readily tolerated while recent and localised, owing to the fact that the unaffected portions and structures are still sufficiently extensive to nourish the ovum, whereas later on at the time of the rapid growth of the placenta, the latter is very liable to apoplexy, and injury to it is far more dangerous than is injury to the decidua; and lastly, that many morbid conditions only permit the fœtus to develop to a certain point (unrectified retroflexions, obstructing tumours). It is mainly in the latter class of cases that abortion comes on regularly when the ovum has reached a certain size, because with this will be associated a certain size of uterus; in all these cases therefore abortion takes place at about the same period. This is usually between the 3rd and 4th month, since when pregnancy lasts longer the irregular position must have been rectified, and the alteration in shape due to the uterine tumour must generally have become adapted to the existing conditions. If therefore the fourth month has passed safely, the danger is much less, although not quite absent, since the diseased uterine wall is still liable to be unequally distended and stretched by the further growth of the ovum, and may thus at a later period be induced to contract prematurely. I have already mentioned that when abortion is due to a given disposition or disease, it is apt to take place at the time at which, were the woman not pregnant, the catamenia would have shown themselves; such dates therefore are especially to be feared. It is also easy to see why *criminal abortion* is almost always practised between the end of the second and the fourth month. Before the end of the second, the uncertainty of the existence of pregnancy is still too great, while after the fourth the object in view, viz. the concealment of the *lapsus*, becomes more difficult.

§ 406. It is well known that women who have once aborted, are apt to abort again in subsequent pregnancies, and at about the same period as before (*habitual abortion* and *premature labour*). When not due to recurrent death of the fœtus (in reference to this point *cf.* § 395), this *impotentia gestandi* depends either on the cause which produced the first mishap (retroflexion, uterine tumour, disease of the mucous membrane) continuing to act, or on disease of the generative system consequent on the first accidental abortion. For there is no reason why abortion should recur after happening once, as has sometimes been supposed. As a last and probably very rare cause of several pregnancies terminating prematurely one after the other, we must, in view of some isolated observations that have been published, admit an undefined constitutional irritability of the uterus, which only allows it to reach to a certain degree of development.

Symptoms and Progress[1].

§ 407. The three symptoms common to every case of abortion are hæmorrhage, "pains," dilatation and stretching of the cervix with opening up of the external os. But their relative importance and order of sequence differ greatly in individual cases. The earlier an abortion takes place and the less marked and strong the "pains," the slighter are the changes in the cervix, and the more copious, relatively speaking, is the hæmorrhage; the later it occurs, the more will the symptoms resemble those of an ordinary labour. This is easily accounted for by the fact that the larger the mass to be expelled, *i.e.* the greater the resistance, the stronger must be the contractions, and the more must the cervix be stretched; in the case of the hæmorrhage however the conditions are usually (although not invariably) reversed, owing to the fact that at an early period the vascular connection between ovum and uterus is relatively more extensive than afterwards.

An abortion occurring during the first weeks of pregnancy, is often very similar to a menstruation accompanied by dysmenorrhœa: there is a temporary severe bearing down, some sacraic pain, some general excitement, and the ovum enveloped in blood-clots and in one or in more pieces is expelled together with its decidua; the woman supposes she has merely lost her menstrual blood which had been retained for some weeks. If pregnancy has advanced further, and has reached the third month, matters are different. *Premonitory* symptoms are now rarely absent, being caused partly by the previous death of the fœtus, partly by the disease of the generative system which induces the abortion, and by the uterine reaction secondary to the disease. They generally consist of a feeling of weight and fulness in the pelvis, of uncomfortable sensations in the hypogastrium, slight gastricismus, frequent micturition, increased discharge of mucus, general depression and disordered sensations. Then come traces of blood and distinct "pains"; which appear first and what relation they hold to one another as regards severity and duration, will mainly depend on the nature of the exciting causes, and on whether the ovum during its expulsion remains intact or not. If the hæmorrhage is slight and does not recur, the symptoms may disappear and the pregnancy quietly continue to run its course[1]. But usually the hæmorrhage soon returns, the pains become more and more distinct and the expulsion takes place slowly or rapidly, according as a state of quiescence again sets in or not; as a rule expulsion will be quicker, the more copious the hæmorrhage was at first.

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[1] In this place I shall merely describe the order of events from a clinical point of view. For the changes in the ovum caused by the extravasations of blood, the reader must refer to §§ 342, 343; for those that take place in a fœtus after its death to § 397.

§ 408. *When an abortion runs a perfectly normal course, the decidua vera and serotina are detached from the uterine wall by the retraction of the latter and by hæmorrhage, the detachment beginning at the internal os and advancing upwards;* the fœtal sac is thus set free, and enveloped in reflexa is driven down by the force of the pains; the cervix is stretched, dilated and elongated, and thus allows the ovum to pass through the external os (where the opposition to it is most prolonged and which therefore remains longest contracted) into the vagina, dragging with it the vera which is at the same time turned inside out. In this way the uterine cavity is completely emptied, and as soon as the organ has become contracted and retracted, the hæmorrhage ceases; in rare cases it may also happen that the decidua is expelled first, followed by the ovum. If however extensive extravasations have previously destroyed the deciduæ and interfered with their several relations, or if there are morbid adhesions of the vera and serotina, the ovum may be expelled with only a portion of those membranes, while the remaining portions are left behind, keep up the hæmorrhage and are expelled by future contractions, although with more difficulty since these cannot so easily bring their force to bear on the fragments. Bits of decidua and placenta are the more apt to be left behind when the fœtal sac bursts (as is not uncommon from undue adhesion of the fœtal membranes to the deciduæ, or from great fragility of the former or even from unnecessary manipulations) during the course of labour, and allows the liquor amnii and the embryo to escape. Indeed not only may portions of the membranes, but the whole of them may be left behind. And this happens much oftener than when labour occurs at a more advanced period of pregnancy, since in the early period the connection of the decidua and placenta with the uterine wall is much more intimate, and since the shortening of the latter during labour and the displacement of the two opposed surfaces one upon the other is much less extensive, and since in abortion it is not uncommon for irregular contractions, especially spasm of the sphincter uteri, to be present; indeed disease of the uterus in not a few cases has a share in causing the abortion.

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[1] I know of some cases in which a small piece of the decidua was discharged, and yet abortion did not take place.

§ 409. As a rule when the deciduæ, or portions of them are left behind, they are expelled soon after the escape of the fœtus; but occasionally after the latter event, the uterus returns to a condition of apparent quiescence, the cervix (no longer stretched by the ovum), especially its internal os, becomes greatly contracted, while the body of the uterus retracts and encloses its contents. This is the condition which Breslau (*Wiener Med. Presse*, 1866, No. 40) has appropriately termed "*incomplete abortion*."

Various terminations are now possible.

a. The most frequent is for the *hæmorrhage to return at intervals*, until the remnants, unless previously removed artificially, are expelled by fresh pains and with increased hæmorrhage; they may be so completely, or only in part. In the latter case after a short period of repose, the attempts at expulsion are repeated till the uterine cavity is entirely empty. This spontaneous evacuation is considerably assisted by the retrogressive changes which take place in the fragments left in the uterus, and by the loosening of their uterine connections which is caused by those changes.

b. In rarer cases *the hæmorrhage ceases entirely for a while*, for days or even weeks, and the woman appears quite well. But all at once severe hæmorrhage and strong "pains" set in, the membranes are expelled and labour is complete. This course of events is chiefly seen when the entire placenta is retained, and the interval may be a very long one[1]. According to my observations, while they do not include as great an interval as some, the final expulsion of any retained remnants, is very apt to take place at the menstrual period, during the sexual excitement that accompanies it. It is clear however that labour, although it commenced long ago, is only now actually completed, from the fact that not till after the expulsion of the placenta do the breasts begin to secrete; I have satisfied myself on this point in three cases. Retention of parts of the ovum with a long interval of repose, seems most often to occur when the placenta is *entirely undetached*; if partially freed, there is probably always more or less constant hæmorrhage. This complete adhesion enables us to understand why the placenta is so often expelled quite intact, and apparently in a fresh condition; for in such cases it continues to derive nutriment from the uterine walls, till the retrogressive changes in the serotina have taken place. Of course the whole process assumes that no air is admitted into the uterine cavity; but this may quite well be the case, when the expulsion of the embryo is unaccompanied by any manipulations within the parturient canal.

c. A much commoner event than that last mentioned, is the *putrefaction* of the retained portions. It occurs especially when these are completely detached or only adherent over a very limited area, and is caused by the entrance of air during the birth of the fœtus or during subsequent digital examinations; it does not however necessarily imply that air has been admitted into the uterus, for the putrefactive processes may have been conducted upwards by fragments hanging down into the vagina and there undergoing putrefaction, or merely by fœtid vaginal secretions. This putrefaction is a source of great danger to the woman, owing to the risk of septic matter being absorbed, and of the thrombi at the placental site or of the lymph channels of the uterus being infected. If in spite of all this, fatal results are as rare as are the last-mentioned sequelæ, this is simply due to the fact that the decomposition almost always takes place relatively late, at a period when a continuous layer of granulations has formed on the parietal mucous membrane of the uterus, and when the uterine sinuses have become firmly thrombosed; indeed the latter are often firmly closed before the actual abortion; it depends further on the fact that the uterine sinuses are not so fully developed during the early part of pregnancy as at a later date, and that during abortion the parturient canal is scarcely ever exposed to the severe mechanical lesions which accompany labour at full time. Hence the abortion, although accompanied by some persistent pyrexia, generally terminates favourably with or without co-existing or intercurrent hæmorrhage, and the threatening symptoms gradually subside in association with a copious, continuous or intermittent discharge of the products of disintegration. Nevertheless in spite of those satisfactory conditions, a disastrous termination due to septicæmia is by no means uncommon.

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[1] Thus Prost (*cf.* Hegar, *Placentarretention*, p. 88) mentions an interval of 103 days; Anderson (*Centralblatt f. Gyn.*, 1878, p. 488) one of 104; Jago (*Med. Times*, April 18, 1868) one of 123; Martin (Zipper, "Zur Lehre von der Nachgeburtsverhaltung bei Abort." *Dissertation*, Berlin, 1868) one of 5 months; and Varsdam (*Centralblatt f. Gyn.*, 1879, p. 191) one of 6 months; &c.

d. The retained remnants of the ovum, or a piece of placenta may form a nucleus around which, while all seems to be going on well, any blood which is from time to time effused is deposited, and with which after coagulating, it becomes closely connected—*fibrinous polypus, placental polypus.* Indeed the latter may arise apart from the retention of fœtal structures; a jagged placental site projecting polypuslike into the uterine cavity is quite sufficient (fig. 75) for the coagula to attach themselves to its thrombi, much in the same way as polypi in the heart form on the rough internal surface of the cardiac walls, and on diseased valves. Such a polypus does not cause any symptoms for some time, and indeed for a much longer time as a rule when it arises after abortion than after an ordinary labour; but on the other hand it is much commoner after the former. In rare cases however an occasional discharge of blood may be present even during the first weeks, while the hæmatoma is in process of formation. The symptoms are hæmorrhage and sensations resembling "pains," which show themselves when the polypoid mass has attained a sufficient size to provoke the uterus to expel it. The hæmorrhage may be very serious and even dangerous to life. A polypus is scarcely ever expelled spontaneously, it must be artificially removed; if left alone, the patient may bleed to death. Moreover since a polypoid mass which is left behind at the time of labour, may undergo putrefaction, the danger of

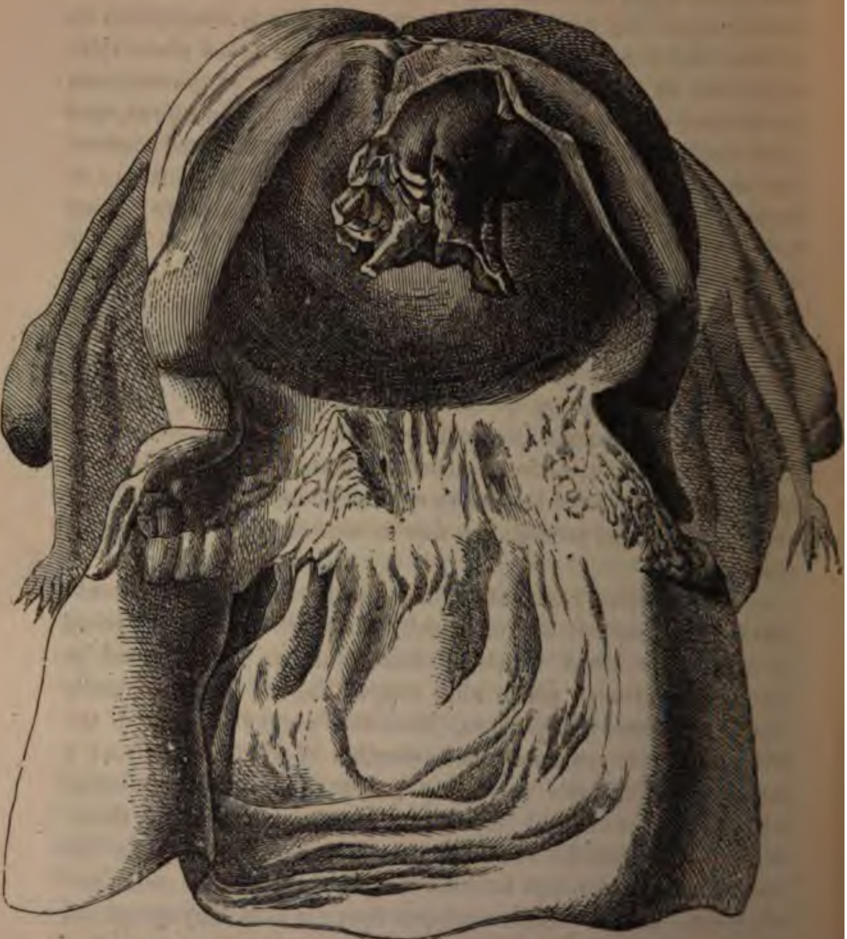

Fig. 75.—Uterus with the nucleus of a fibrinous polypus after abortion (natural size). From a preparation in the Museum at Breslau (*cf.* also Fränkel, *Arch. f. Gyn.*, ii.).

septic absorption is superadded to that of hæmorrhage, as happened to a patient treated in the hospital here, and whose case has been described by Fränkel; I have met with two similar ones.

§ 410. The *uterus becomes involuted* after abortion, in the same way as after normal labour, and the lacteal secretion also shows itself; these phenomena however correspond in intensity with the slighter previous development, and run a relatively quicker course. But while, for the reasons given above, severe traumatic and septic complications are rare, the processes of involution are hindered and diseases of the generative organs appear much more often than after ordinary premature or full time labours. This is due on the one hand to the causes which produced the abortion, on the other hand to the frequently unsuitable treatment, to want of care during the abortion and even more to the inadequate precautions taken after its termination. The commonest sequelæ, apart from persistent anæmia, are para- and perimetritis (especially the former), and are caused in part by extravasation; but subinvolution is the evil effect which lasts longest. It is mainly from these affections that arise those disorders from which women suffer so much and so long, frequently for years: infarction, chronic catarrh, retro-flexion and -version, condensation and cicatrisation of the pelvic areolar tissue, menstrual disorders, tendency to renewed abortion.

§ 411. Although the *prognosis* of abortion, as far as immediate danger is concerned, can hardly be called bad, yet it is not favourable in reference to the permanent health of the patient. No doubt the number of women who abort without being injured in any way is not small, but my experience does not allow me to look upon abortion as such an insignificant event, a mere incident, as is not uncommonly done. Moreover as regards the immediate sequelæ, although it is very rare for a woman to bleed to death either immediately or in consequence of incomplete abortion, and to be attacked by septicæmia, yet the possible occurrence of these events must always be borne in mind. I have known of several instances in which women bled to death, and of a number in which death supervened from puerperal diseases —reason enough for watching every abortion carefully.

Lastly, it may be mentioned here that inversion of the uterus[1] and tetanus have been seen after abortion.

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[1] Several such cases are referred to under "Inversion," § 710.

Diagnosis.

§ 412. The diagnosis of abortion is very simple, when a digital examination reveals the ovum actually in process of expulsion, or if after such expulsion the ovum can be examined, and the condition of the uterus is found to correspond. It is not so simple, when this evidence is not forthcoming; when the cervix is still closed, or has contracted again after expulsion of the ovum, and when none of the discharged portions are at hand. The *greatest difficulty* in these cases, at any rate during the first two months, *is to determine whether pregnancy existed at all;* with an abortion at a later period, the enlargement of the uterus, or its puerperal changes are too characteristic to be mistaken either in a positive or negative sense, and I must therefore refer to what has been said in §§ 128—130. During the first 8 weeks, there may be very great difficulty in knowing whether the case is one of abortion, or of a menstruation associated with dysmenorrhœa, which has re-appeared after a month's interval; the general features of the case must decide the question unless definite pains soon come on and the characteristic alterations in the shape of the cervix or even the discharged parts of the embryo, prove that abortion has occurred. Where there is doubt, it will always be best to look upon hæmorrhage after a temporary cessation of menses, especially in previously healthy women, as an abortion, and to base both the immediate and future treatment on this view.

Where the existence of pregnancy is undoubted, 3 questions may require an answer: 1. is the abortion in progress; 2. has it taken place; and 3, have portions of the ovum been left behind?

§ 413. In answering 1, we have characteristic and positive signs to help us: hæmorrhage, uterine contractions, dilatation of the cervix together with thinning and softening of the edges of the os. Nevertheless hæmorrhage and even "pains" do not absolutely prove that the ovum will be expelled, since, as already mentioned, they may again subside if the detachment is not very extensive, and indeed without doing permanent harm; but they are at any rate prodromal symptoms. On the other hand the discharge of coagula, especially if somewhat altered, is a fairly certain sign that the abortion is in progress, since they indicate that the detachment of the ovum is somewhat extensive and has existed for some time, and since their discharge presupposes expulsive activity; amongst perfectly incontrovertible signs (of course in addition to the discharge of portions of decidua and chorion) may be mentioned the changes in the cervix effected by labour, for these can only be caused by a displacement of the uterine contents, *i.e.* of the ovum. It is true that very similar physical signs accompany the expulsion of intra-uterine fibroids; but the latter event can scarcely be mistaken for abortion, irrespective of the absence of the characteristic changes of pregnancy, and of the clinical history.

Question 2, whether the *abortion has already taken place*, is most likely to arise if the patient is only seen after she has been suffering for a time from more or less severe attacks of hæmorrhage and pains, and if coagula have been discharged which were not carefully examined. Under such circumstances the shape of the cervix, especially when compared with that of the body, has almost always enabled me to arrive at a certain diagnosis. During the birth of the ovum, the cervix uteri forms a more or less cystlike organ, which, widening as it passes upwards, merges into the body of the uterus without distinct external margin, while the transverse longitudinal section of the whole organ would form an oval with its small end downwards; on the other hand when the ovum (or merely the liquor amnii and the embryo) is expelled, the distended cervix collapses, the internal os contracts, and the cervix resembles a funnel which grows narrower from below upwards and is suspended from the body, so that a similar transverse section would be approximately hourglass in form. In addition to these signs we have the further one that the body of the uterus appears distended before the ovum is expelled, but much flatter after such expulsion; in the former case its transverse section has a circular, in the latter an elliptical outline. It is only when an abortion has taken place quite early and with a very small ovum, or when a nucleated, soft and very compressible ovum has been expelled, and the membranes have ruptured early, *i.e.* when the distention of the cervix was slight, that I have missed the pathognomonic signs that I have mentioned, and which depend on such distention, or that I have not found them developed in a characteristic way.

Question 3, dealing with the *completeness of the abortion*, cannot involve any difficulty, if all the parts of the ovum are found in the expelled mass, or if they have been seen by a trustworthy third person. When this is not the case, we may conclude that the uterine cavity is entirely emptied, if the hæmorrhage ceases or continues for a couple of days in small and diminishing quantity, while the uterus is firmly contracted, of elliptical transverse section, and if its size gradually diminishes.

Conversely, persistent hæmorrhage increasing at intervals with or without pains, especially if large coagula are discharged at the same time, points to retention of parts of the ovum, or to clots having become adherent to the uterine parietes, a view which will be placed beyond doubt, if such can be felt within or below the internal os. But even where the given symptoms are absent, it is well in cases of uncertainty as to whether everything has come away, and bearing in mind what has been said above in reference to the occurrence of an interval before the completion of labour, always to think of the retention of some portions as probable, so long as the uterus remains large and globular, and the regular puerperal involution is absent[1].

Lastly, whenever unsatisfactory symptoms point to retention, and render a definite diagnosis essential, this may be obtained by a bimanual exploration of the cavity of the uterus, and if necessary by dilating the cervix (by a tent or otherwise) and cautiously scraping the inner surface of the uterus with a curette; these procedures either directly or by exciting contractions, and by opening up the uterus, render its cavity and its contents accessible, and in regard to these procedures we have the good fortune that the very measures which are most useful for making a diagnosis, have also a therapeutical effect, and indeed as a rule to a very decided degree.

Treatment.

§ 414. Treatment has for its object the prevention of abortion where there is a tendency to it, the arrest of any such mishap that is threatening to occur, and the use of such means as will avert injurious consequences, when an abortion has taken place.

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[1] In reference to this point it must be borne in mind that there may have been a multiple pregnancy, and that after the abortion of one fœtus, the other may be retained and of course be alive.

General *prophylaxis* consists in following the ordinary dietetic rules for pregnant women. Special prophylaxis is only requisite if the woman has previously aborted, and under such circumstances it will of course be necessary before conception again takes place. It presupposes the most accurate information of the factors concerned in the ætiology, for without such information effectual treatment is impossible. In view of what has been said above (*cf.* especially § 395), I need not recapitulate those factors here, or mention the means that should be adopted. In those cases in which it is absolutely impossible to discover an adequate cause, it is well to recommend a prolonged abstinence from sexual intercourse, since a morbid condition of the generative organs, especially of the uterus, should always be thought of first as not unlikely, and those organs can only recover and return to their normal condition after a considerable period of rest; moreover special "irritability" of the uterus can only be counter-acted by a long time of functional inactivity, and by a gradual and uninterrupted (by a fresh conception) improvement in the general health.

When a woman who has previously aborted, again becomes pregnant, it may sometimes still be possible to treat the cause of the former abortion (*e.g.* syphilis), but in most such cases we can merely treat the symptoms. The woman must as far as possible avoid everything that might do her harm, keep as quiet as she can without interfering with good digestion, and entirely renounce coitus; special care is necessary on those days on which, were she not pregnant, menstruation would have set in, particularly about the time at which the previous abortion took place.

§ 415. If *premonitory symptoms* of abortion show themselves, or even if very distinct symptoms of it appear, an attempt should always be made to check its progress; for there are extremely few times in which abortion would seem a desirable event. Even when we are sure that it is unavoidable, when it is clear that the fœtus is dead, delay is good, for the hæmorrhage is generally in inverse proportion to the time that has elapsed since the death of the fœtus, and the placenta and membranes, owing to the progressive retrograde changes that take place in them, are more and more easily detached after such death. It is therefore always well to make an attempt to avert the threatening mishap, at any rate until the expulsion of large blood-clots or bits of decidua, or the fact that the displaced ovum is forced into the cervix proves the uterus to be empty. The means to be employed for the purpose will vary, but the general principle must be remembered that the generative tract must on no account be irritated; no unnecessary examinations are to be made, no cold applications used, no ergot administered, the greatest possible physical and mental repose must be enjoined, the patient kept cool (cool coverings, simple diet, acidulated drinks), her often excited nervous system, and above all uterine contractions must be soothed (opiates, nervine tonics, warm applications to the hypogastrium). Among internal remedies, I can strongly recommend large doses of acetate of lead, either alone or combined with small quantities of digitalis. On the other hand laxatives are preferable to enemata, for the latter have a directly irritating action on the uterus. Should it appear necessary to wash out the bowel, this must be done according to Simon's method. Lastly, if all these measures are to succeed, they must be prolonged for at least several days after the threatening symptoms have disappeared.

§ 416. If the measures referred to prove useless, and the signs enumerated above prove clearly that *abortion cannot be averted*, we must endeavour to steer our patient safely through its dangers. The previous *régime* must be continued for a while, and as long as the hæmorrhage is moderate in quantity and without injurious effect on the constitution, a purely expectant treatment should be adhered to[1]. Should however the opposite condition arise, *the abortion must be accelerated;* for the shorter the period of expulsion of the ovum, the shorter will the bleeding last.

The ovum can be most rapidly *extracted by the hand.* This method however is only allowable, when the ovum is entirely detached and lies in the cervix and vagina, *i.e.* when it has actually left the uterine cavity; in all other cases, and they form by far the majority of those which call for treatment, I believe it to be *bad practice to remove the ovum.* In consequence of the limited size of the uterine cavity, we cannot be sure that our finger will detach the connections of the ovum in a clean and

[1] Women with cardiac disease, especially those suffering from a fatty or dilated heart, form an exception to this rule, inasmuch as they are usually injuriously affected by even a slight loss of blood, and are apt to collapse under it. Such women must never be allowed to bleed for any length of time, even though the blood flows *guttatim*.

complete manner, and this detachment of course must precede the extraction; some fragments are generally left behind. Moreover the proceeding is very damaging to the uterus, and there is the further reason for not making the attempt, since plugging the cervix and vagina is a perfectly safe way of arresting the hæmorrhage, and of increasing the force of the pains.

The cervical canal can only be plugged, while still rather narrow and long; otherwise the tampons find no basis of support. The only good way of plugging is to introduce one or more thick laminaria or tupelo tents side by side, or else thick sponge tents; cotton wool or linen plugs are soon pushed down from the cervix, and moreover do not swell sufficiently. The dilating materials first mentioned must of course be thoroughly disinfected before use, the vagina being previously cleansed with 2 per cent. carbolic water. The laminaria tents are preferable to those of compressed sponge, since the latter can never be so thoroughly disinfected as the former, and therefore must never be left in as long, at most 2—3 hours. *Plugging the vagina* is suitable for all cases, whether the cervix be narrow or quite wide. When the plug is removed after some hours, the ovum is generally found above it either detached or easily removable, but should there be occasion the plug can easily (either at once or after an interval) be re-introduced without causing the woman much pain.

Other methods of arresting hæmorrhage and increasing the force of uterine contractions, are *hot vaginal irrigations*, and cold applications to the abdomen. The patient soon becomes tired of the latter plan, which indeed is rather apt to cause chills. The former is probably more efficient, although the irrigations are somewhat troublesome in private practice, at any rate where conveniences are few, while they are in a measure open to the same objections as are cold fomentations. Occasionally the administration of ergot either internally as an infusion, or subcutaneously in the form of ergotin is of value.

§ 417. As this is the first time that I have spoken of *plugging the vagina*, I may here describe the *best way* of doing it. If the main object is to increase the force of pains, I recommend an *india-rubber bag* (thoroughly disinfected); it distends the vagina and thus induces uterine contractions. But it cannot be recommended, when the hæmorrhage is copious and requires close supervision. For the bag which is distending the vagina is invariably pushed down by the bearing down efforts nearly to the perinæum, the latter with the narrow vulva alone preventing it from slipping out; blood can accumulate above it, indeed flow past it, and again collect above. Still more important is the fact that the bag exerts no, or almost no, force in an upward direction, it exerts no pressure on the fundus vaginæ or the lower segment of the uterus, and this is clearly essential for the arrest of the hæmorrhage. If on the other hand the bag is introduced into the upper portions of the vagina, and is so distended that it cannot be pushed down, it will cause intolerable pain and bearing down. For this reason I have for some years both in hospital and private practice (and probably every one that has watched my proceeding has adopted it) used *cotton wool tampons applied* (which is an important point) *merely to the fundus vaginæ.* My method requires no instruments, except a pair of long, narrow dressing forceps with toothed edges. A large number of pledgets of cotton wool[1] as large as a walnut or egg (N.B. the soaking in water or vinegar is superfluous and irritating) having been got ready, the operator seats himself on the left side and facing his horizontal patient, and introduces two fingers into the (previously irrigated) vagina; by separating them he widely dilates the posterior portion of the vulva. He then takes the forceps in his right hand, seizes the pledgets of cotton wool and pushes them one after the other into the vagina, while at the same time the intra-vaginal finger presses them firmly into every part of the vaginal fundus, till the cervix uteri is closely covered, and the vaginal fundus is distended, completely filled and forced up; if meanwhile a third person presses on the uterus from without (subsequent pressure being made by means of a firm compress), the lower segment of the uterus will be still more thoroughly compressed. The whole of this proceeding is over in a couple of minutes, it involves no pain or exposure of the patient, requires neither light nor assistance, and the vagina and uterus are left so plugged that no drop of blood can flow out. The removal of the plug is as easy as its introduction; the rima pudendi is opened as before, the vagina is irrigated with tepid carbolic water and the bits of cotton wool are extracted with the forceps which, guided by the fingers that remain *in situ* and without any discomfort to the woman, pass easily and rapidly in and out of the vulva as often as necessary, bringing with them the pledgets that they have seized; lastly, the carbolic irrigation is to be repeated. It is quite unnecessary to arm the several pledgets with threads before introducing them, in order to facilitate the future extraction. Nor is there any earthly reason for applying perchloride of iron to the plugs; this irritates and corrugates the vagina to such an extent that any further manipulations that may be requisite, involve great difficulty, and cause the woman acute suffering.

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[1] Carbolic or salicylic wool, or at any rate ordinary surgical wool, should be used; the separate pledgets being anointed with 5 per cent. carbolic oil.

§ 418. If the ovum ruptures in the course of labour and discharges its contents, *while the secundines remain behind, the expulsion of the latter should be patiently awaited, if the bleeding and general condition of the patient permit. But if this cannot be done, a fresh plug must be inserted.* There is but little risk even if blood does collect in the uterus under these circumstances, since while the dimensions of the uterine cavity are so small, such accumulation cannot be of much consequence. Nevertheless if the walls of the uterus are lax, preparations of ergot may be given. If when the plugs are removed, *the placenta and membranes are found to be neither detached nor extruded from the uterine cavity, they must be directly removed;* for repeated plugging is inconvenient, it soon becomes irksome to the patient, irritates the generative tract, while the material used becomes decomposed and sets up a similar change in its vicinity.

In many cases *the secundines can be expressed* (Höning) by firmly grasping the body of the uterus, and pushing it down (much in the same way as the placenta is expressed after ordinary labour) upon the two fingers which are lying in the anterior, or (if the uterus is inclined backwards) posterior vaginal *cul de sac*. But this procedure will only succeed, when the uterine walls are flaccid, when the after-birth is detached or easily separable, and when the abdominal walls are very lax and but little sensitive. Should these conditions not be present, the *remnants must be directly extracted from the uterine cavity.*

§ 419. This extraction should always be done by the hand, if possible. The middle and index fingers usually suffice for the purpose; it is not often necessary to introduce half or the whole of the hand into the vagina, but when it is, the patient must be chloroformed. If the uterus is now pushed firmly down (by means of external pressure) towards the fingers in the vagina, and at the same time forced down on the finger lying in the uterus, that finger can without difficulty remove all the adherent portions, and draw down what it has detached. The various kinds of forceps recommended for extracting the retained masses are superfluous, and therefore to be rejected; they cannot take hold of such friable substances.

It is only when the latter are unusually firmly adherent to the uterine wall, and when (owing to undue sensitiveness of the abdominal walls and uterus, or to irritability and narrowness of its sphincter, or to a narrow and rigid condition of the whole cervix) the bimanual method referred to does not succeed, that the *fenestrated curette* or Simon's *scoop* may be used for detaching, breaking up, and extracting the remnants, and I can after large experience strongly recommend these instruments as well adapted for the purpose and not dangerous[1]; the curette is to be preferred to the scooped scraper, since its fenestræ admit the detached parts and thus readily draw them out. If some small portions are left behind after the scraping, these are soon spontaneously expelled, especially when, as should always be done, their disintegration and elimination are assisted by cauterisation and irrigation of the uterine cavity. It is scarcely ever necessary to dilate the cervix and the internal os by tents, before introducing the curette; for a uterus with retained masses almost always allows the instrument to enter without preparation; and thus the risk of infection, which always to some extent accompanies the use of tents, is avoided; and further, what is not unimportant, the evacuation is completed in a couple of minutes and with scarcely any pain. The use of the curette is therefore at the same time the milder procedure.

In order to allow the curette to be rapidly and certainly introduced and to be safely applied to the inner surface of the uterus, it is necessary to fix the latter; the patient must lie on her side during the operation and, a Sims' speculum having been introduced, the anterior cervical lip must be seized with a small vulsellum. The scraping is usually accompanied by some hæmorrhage, but this ceases as soon as the little operation is completed. A small piece of cotton wool should now be twisted round the ends of a pair of dressing forceps, these being used to swab out the cavity of the uterus; the latter is then to be cauterised by another piece of cotton wool held in a similar way, and dipped in pure carbolic acid. This acid is the best caustic, since it corrugates the cervix uteri and the vagina but little (less than does perchloride of iron), and since the disintegrating matters resist decomposition for a long time, when carbolic acid is used as an escharotic; moreover the early intra-uterine irrigation which is very desirable after other modes of cauterisation, although very difficult owing to contraction of the internal os, is rendered unnecessary by the method I have mentioned.

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[1] I feel obliged to point out that this recommendation was made in the 1st edition of this book, which appeared long before Bœters (who uses the scoop) and Mundé (wire curette) published their views on this subject; I am compelled to do this, since in the writings of these and other authors my recommendations are entirely ignored. Of course it matters little as regards the essential objects of the proceeding, which out of these very similar instruments is selected.

§ 420. When the operation is over, the uterus must be left alone unless symptoms of septicæmia show themselves, and this is extremely rare; vaginal douches may be used as often as necessary. If bleeding continues after the removal of the remnants of the ovum, as happens in very exceptional cases, cold vaginal irrigations may be resorted to, or if the hæmorrhage is very profuse, tampons may be applied to the fundus vaginæ; in the latter case the curette will most likely have to be applied again, since there probably still remain some considerable portions of the ovum. The use of ergot or ergotin for some days is always advisable, so as to ensure the retraction of the uterus.

Lastly, if it should be necessary to dilate the lower segment of the uterus before removing the remnants of the ovum, tents must be used, as directed in § 416.

§ 421. When the retained portions undergo *decomposition*, they should of course be removed with as little delay as possible. But these cases will require great caution; sponge tents especially should be avoided, the curette being preferred if the fingers alone are not sufficient. The curette must not be allowed to scrape the uterine wall too deeply, for if the actual uterine tissues are wounded, lymph channels will be laid bare, which may at once absorb the septic matters that are present and thus pave the way for septic metritis and general septicæmia; I have seen examples of this. The curette should therefore mainly act on the retained masses, these being broken up as much as possible, and then extracted, a matter which is generally easy; any remnants may be washed out either at once, or by degrees with the uterine catheter and a 2 per cent. carbolic solution. It is especially important in these cases to cauterise the uterine cavity with carbolic acid immediately after the use of the curette and the removal of the larger portions.

If some *portions are retained without any urgent symptoms* showing themselves, the woman should be patiently watched and kept under observation until everything has come away, she herself as well as her friends being directed to call in assistance at the first indication of hæmorrhage.

The *after treatment* of abortion is the same as that of every childbed, but inasmuch as the involution of the uterus after abortion is usually slow and often incomplete, and remembering also the numerous morbid sequelæ, a woman should be urged to take as much or even more care of herself after an abortion than after an ordinary labour. As regards the treatment of the immediate consequences of very copious losses of blood, I must refer to § 428.

b. Hæmorrhage after the 28*th Week.*

§ 422. During the second half of pregnancy, the vascular connection between mother and fœtus is effected by the placenta alone; hæmorrhage during this period is therefore due to a more or less extensive detachment of the latter. Of course such detachment is also the source in by no means a few cases of abortion, and indeed may be the cause of it. Our reasons however for describing hæmorrhage occurring during the last twelve weeks separately from that occurring earlier, are because during the later period the causes which produce detachment of the placenta are generally different from those operating during the first months; further because the hæmorrhage generally runs a different course than in the latter period, because the labour that sets in in consequence of the bleeding is a "premature labour" in the narrower sense of the expression, so that the child also needs to be considered, and lastly because similar attacks of hæmorrhage, as far as the ætiology is concerned, accompany the onset of labour at the full time.

The chief cause of premature detachment of the placenta is its insertion into the lower segment of the uterus—placenta prævia; detachment of the normally situated placenta must be separately considered, because of its totally different significance.

(1) *Hæmorrhage due to the Detachment of the normally inserted Placenta.*

§ 423. Slight attacks of this form of hæmorrhage are not uncommon; severe ones are exceptional. They occur more often during the first stage of labour than during pregnancy, since that stage brings with it an important factor in their causation, viz. contractions. What we say here therefore holds good for similar hæmorrhage in parturient women.

Detachment of the placenta may be *due to uterine contractions, to effusion of blood* caused by disease of the placenta or by constitutional affections, or *to mechanical disturbance.* The first cause leads to a displacement of the area of placental attachment, then to hæmorrhage at that place, and the coagulated blood may lead to further detachment and contractions. The immediate cause of the contractions is often difficult to discover, and their onset cannot as a rule be ascribed to any definite conditions. We know however that great general excitement or emotional disturbance may lead to contractions (especially the partial contractions which are so apt to cause separation), and that these also sometimes show themselves in rheumatic and inflammatory conditions of the abdominal organs, particularly of the uterus. It is easier to understand why pains should set in prematurely when the uterine tissues are diseased (as in the case of intraparietal new growths), or when the organ grows irregularly owing to anomalies in shape, for the mere irritation arising from the unequal growth is enough to excite contractions. During the period of dilatation, it is chiefly the sudden diminution of the cavity of the uterus after sudden discharge of the liquor amnii which leads to detachment of the placenta.

Primary effusion of blood is generally a consequence of disease of the placenta, and is rare during the later period of pregnancy; in the latter it is generally caused by some excessive flow of blood associated with anomalies of the circulatory organs, or by alterations of the walls of the vessels dependent upon abnormal conditions of the blood; these latter conditions are of great importance, for it seems that the severest cases of the kind of hæmorrhage we are now discussing, occur in anæmic, physically reduced individuals. The actual detachment of the placenta is most often due to some *mechanical shock,* either produced by external agency or by the person's own movements, sc. by a jump or driving on bad roads, by a slip, by the effort of vomiting or strong expiratory acts.

§ 424. *The hæmorrhage may be external or internal*, or both. When external, the blood either flows out in a stream or in gushes; this will depend on the position of the bleeding spot and on the several causes which might obstruct its free outflow. Occasionally the bleeding only occurs once; but generally, where the quantity is at all considerable, the hæmorrhage returns, and labour takes place in consequence. As soon as the uterus has grown distinctly smaller with the onset of the latter, the hæmorrhage ceases. On the other hand hæmorrhage which is directly due to a sudden diminution in the size of the uterus, shows itself for the most part as a single gush of blood, which is not followed by any more, provided that strong pains continue; when they do not, it is possible that the hæmorrhage may last longer. Sometimes when the hæmorrhage is external (both after and before it), the pregnant woman feels a fulness and distention of the abdomen, a straining and bearing down; she may also show signs of anæmia, as is easily accounted for by the quantity of blood which has been lost; in such a case *internal* hæmorrhage will doubtless also be present.

Hæmorrhage may be internal, owing to the fact that the effused blood cannot get past the presenting part of the fœtus which is firmly applied to the uterus; or else that it collects between the uterine wall and the fœtal membranes, when the latter are firmly adherent at certain spots, or between the uterus and the placenta; or lastly to the fact that it breaks through the placenta and membranes, and enters the fœtal cavity. The latter is the rarest occurrence, but the most curious condition is seen when the accumulation takes place between the placenta and the uterine wall, for it presupposes that the edges of the former are firmly adherent on every side. This *central detachment of the placenta* is doubted by a few obstetricians, but we have the record of cases which terminated fatally (Dublin Hospital Reports), and apart from some that are not quite reliable, and from one related by Scanzoni in his Text Book, such an occurrence is most accurately described by Oldham in the Guy's Hospital Reports for 1856; The *London Obstetrical Transactions* (vol. vi., 1865) contains another by Gant, in which the clot weighed 1 lb. 4 oz.

Internal hæmorrhage is rare, if we leave out of consideration those slight extravasations whose remains are so often found in the placenta after delivery, without their having had any prejudicial effects. It is the profuse internal effusions that are most frequent in the above-mentioned reduced women, and in unhealthy states of the blood; probably the condition of the uterus has also some influence on their production, for they are most common in women who have borne many children, especially therefore in elderly women.

The *symptoms of internal hæmorrhage* are both local and constitutional. To the former belong severe pain and an increasing sense of well-nigh intolerable fulness in the uterus, as if it were stretched more particularly in its length, and had altered in shape; in some cases the position of the accumulated blood has been indicated by the prominence of some portion of the uterus which could be distinctly made out through the abdominal walls (Scanzoni, Leroux, Levret, Duncan). The constitutional symptoms are those of a rapidly developing anæmia and collapse (prostration, loss of consciousness, vomiting, &c.); the latter is not merely a consequence of the anæmia, but must be regarded as of the nature of shock, as a reflex paralysis caused by the distention of the uterus.

§ 425. The *prognosis* in a case where the hæmorrhage is purely external, is not bad, provided that such hæmorrhage is not copious, and that the patient is seen before she has lost much blood; under such circumstances it ought not to be difficult to control the bleeding. For the fœtus of course the accident is always dangerous, since a more or less extensive portion of its respiratory surface is detached, and we are not always in a position to withdraw it rapidly from the impending asphyxia. Internal hæmorrhage on the contrary is serious, since it is generally only detected when considerable effusion has taken place (for this reason the prognosis of co-existing internal and external hæmorrhage is better than that of the concealed), since disease of the uterine wall and vessels is usually at the bottom of it, and since hæmorrhage not uncommonly continues even after the uterus has been emptied; the danger is therefore increased, if strong pains are absent. Goodell and Hennig estimate that 56 out of 110 mothers die, while out of 111 fœtuses only 7 are saved, a proportion which will not cause surprise; equally unfavourable are the results of cases treated in England, for Brunton found that 19 out of 32 cases ended fatally[1].

§ 426. It cannot be difficult to recognise the *nature of the hæmorrhage*, if it is borne in mind that the only two other possible causes are rupture of the uterus and placenta prævia, and each of these conditions can be easily excluded by a consideration of their peculiar symptoms. Where there has been nothing to cause rupture, and no sign of placenta prævia, every hæmorrhage is to be looked upon as of the nature we are now discussing. Internal hæmorrhage is recognised by the local and constitutional symptoms that have been already mentioned, but to some extent these same symptoms are seen in so many other sudden diseases, that in any particular instance it may be difficult to arrive at a certain diagnosis. Such diagnosis may be greatly assisted, if the tense bag of membranes is felt through the os (through the mass of blood lying outside it), and if blood-stained serum or even a clot is discharged by the side of the finger.

§ 427. When the external hæmorrhage is moderate in quantity, the *treatment* involves exactly the same regimen, as was recommended for the slight hæmorrhages which precede abortion. If at all copious, they must be arrested by firm *vaginal tampons*: during which treatment however the onset of internal hæmorrhage must be looked for and prevented by carefully supervising the body of the uterus with the hand. It is true that the tampons provoke expulsive activity; but this is just what is wanted, since when the hæmorrhage is considerable, an extensive detachment of the placenta has doubtless taken place; the spontaneous onset of labour is therefore to be expected, and pains are now the most certain means of checking the hæmorrhage. Hence it is well, if the cervix is properly prepared for labour, to *rupture the fœtal membranes*, for the great diminution of the uterus which follows upon the discharge of the liquor amnii is more likely than anything else to check the bleeding. But the liquor amnii should be allowed to flow off slowly, the most unceasing supervision and compression of the uterus from without being kept up, and of course some form of ergot must be administered.

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[1] Since the publication of these statistics, a further series of cases of this kind of internal hæmorrhage has been recorded, which also shows how great is the risk that accompanies this hæmorrhage. *Cf. inter alios* Maberly, *Obstetrical J. Great Britain*, April, 1877, p. 40; and Weatherley, *British Medical Journal*, Aug. 24, 1878.

When hæmorrhage comes on after premature discharge of the liquor amnii, the use of tampons is not desirable as a general rule, since in these cases the danger of internal hæmorrhage is very great. Nevertheless, nothing can be objected to their use in a particular case, if meanwhile such risk can be guarded against. In all such cases it is better to plug the cervix and the lower segment of the body by a Barnes' or Tarnier's bag, than to plug the vagina. This is far the quickest way of stretching the cervix and dilating the os; the pains are made much stronger, and it is possible to terminate labour artificially much quicker than after plugging the vagina.

§ 428. *When there is very profuse internal hæmorrhage, it is not well to interfere too hastily,* nor to rupture the membranes as early as is generally recommended. For as long as the effused blood continues in the uterine cavity, and stretches its parietes, this stretching and the raised intra-uterine pressure prevents any more blood being poured out, while conversely if the uterus is emptied, fresh bleeding may at once begin. The sudden discharge of blood and the shock to the system which accompanies it (*e.g.* anæmia of the brain and heart) may moreover increase the already severe collapse, till it proves fatal. It is therefore best to begin by ordering general stimulants and restoratives, to give the patient time to recover, and to enable thrombi to form at the seat of hæmorrhage, and to grow firm. If now, while the body of the uterus is subjected to the most unceasing and careful supervision, its lower segment becomes better prepared for the exit of the fœtus, the membranes may be ruptured, the liquor amnii allowed to flow off slowly, and the exit of the fœtus assisted by expression; the latter is also the safest means of preventing fresh relaxation of the uterus and fresh hæmorrhage. The mass of blood clots should, for the reasons mentioned, only be removed, if they lie close to the orifice of the uterus, and even then no force must be used. The delivery must on no account be undertaken and completed in a hurry, never be an "accouchement forcé"; if the dilatation of the cervix is delayed, this may be assisted by the introduction of large bags into the lower portion of the body; they may be useful even after the discharge of the liquor amnii, since they entirely or approximately replace the distention of the uterine wall which the liquor amnii was previously causing. The placenta is usually expelled together with large quantities of accumulated blood; on account of the risk of subsequent bleeding and increased collapse their removal should never be hurried; it is better to express them cautiously.

It will be obvious from what has been said above that recurrent hæmorrhage due to insufficient retraction of the uterus is especially to be dreaded with this internal bleeding. The delivered woman must therefore be watched with especial care. I shall speak of the treatment later on in dealing with that of post-partum hæmorrhage, and at the same time will discuss the treatment of acute anæmia.

(2) *Hæmorrhage due to the Insertion of the Placenta at the Lower Segment of the Uterus—Placenta Prævia.*

§ 429. By placenta prævia is meant a condition in which a more or less considerable portion of the placenta is inserted into that portion of the lower segment of the body of the uterus which is stretched by "pains," and therefore during labour. In some cases the placenta is almost uniformly spread out over this surface, *i.e.* extends all round the internal os, a lobe of varying size projecting over that os. In others one border of the placenta may only just reach it, or a narrow edge 2—3 cm. (·8—1·2 in.) wide may extend over the yet closed os; or lastly a portion of the placenta may merely lie in the "area of expansion" without reaching the internal os. Hence various degrees of placenta prævia are distinguished, placenta prævia *centralis*, *marginalis* and *lateralis*.

§ 430. The lower portion of the cavity of the uterus may be looked upon as the segment of a hemisphere which under the influence of "pains," and in consequence of dilatation of the internal os and of stretching of the edges and the neighbouring portions of the latter, is converted into a cylindrical canal. With the onset of "fixing pains," and during the dilatation period, the lower portion of the uterus is stretched transversely, and the placenta, if inserted into this portion, must therefore be detached by the stretching, while, if normally inserted, it will be loosened through a contraction of the area of attachment. Of course the lower segment of the body of the uterus is at the same time shortened and retracted in a perpendicular direction parallel to the axis of the uterus; but this shortening is insignificant during the first stage of labour, and contributes no more towards loosening the placenta than it does during this stage with a normal insertion; this longitudinal retraction has merely the effect of causing the detached portion of the placenta to appear to travel further down, to be brought into the os uteri and nearer to the examining finger[1]. A similar instance of separation of the placenta through stretching of its area of insertion, is seen in many cases of hydramnios, in which a normally inserted placenta is prematurely detached by the undue distention.

The stretching of the lower segment of the uterus is greatest at that portion which lies nearly at a right angle with the axis of the organ, therefore close to the internal os. It will be less at any portion, the higher up the latter is placed, the more it runs parallel to the uterine axis. The parallelism begins at a distance of at most 6 cm. (2·25 in.) from the middle of the internal os, if measured in a continuous line, of 4 cm. (1·5 in.), if measured in a vertical direction. A circle carried transversely through the uterus at this boundary has a diameter of about 11 cm. (4·5 in.), and this is just enough to allow the fœtus to pass through. The expansion therefore does not extend beyond these 6 cm. from the middle of the internal os. The placenta will be prævia, if it is situated wholly or partly in the segment thus defined, and when the latter is stretched, as it must be during labour, the placenta must inevitably be detached; this is just as physiological an event as is the loosening which occurs with a normal insertion, when the area of attachment is diminished by concentric contraction. But while in the latter case such contraction arrests the blood which follows upon the detachment, in the former the stretching cannot do so, and herein, certainly not in any obstruction that placenta prævia offers to the delivery of the child, lies the great importance of the malposition; it was this error which led to the former view, that because the placenta preceded the fœtus, it must be born first, and required therefore to be detached before delivery could take place.

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[1] This is not due, at least not to any important extent, to descent of the ovum; for at the period of labour at which the events described take place, the ovum does not descend to any appreciable degree; it is merely that the extensible fœtal membranes are somewhat pushed, and made to bulge downwards.

It may be mentioned here that the hæmorrhage is mainly derived from the uterine sinuses at the area of insertion which have been laid bare, and from the uterine arteries which open into the substance of the placenta and are likewise divided by the detachment; the arteries however contract and close, almost as soon as they are torn through. A gush may take place from the opened marginal vessel of the placenta, as well as from the great cavernous spaces at the moment that the placenta is detached, but it is only momentary, since thrombosis immediately closes up this source of hæmorrhage. Hence it follows that the blood cannot pass from the still adherent portions of the placenta through the detached ones, and then flow out, *i.e.* the placenta cannot bleed directly, as some authors (*e.g.* Sir James Simpson) have asserted.

§ 431. We are to a large extent ignorant of the *causes* of placenta prævia. We merely know that the majority of cases occur in multiparæ, that a rapid recurrence of pregnancies is on the whole favourable (large size of uterine cavity or patency of the Fallopian orifices), that previous abortions have a predisposing influence, and that this dangerous condition is most often met with in the poorer classes, possibly owing to hard work at the beginning of pregnancy, and still more to the subinvolution of the uterus which is so common in this class. Recurrence of the malposition has been seen[1], still more frequently a coexistence of placenta prævia with twins.

Ingleby mentions two curious cases in which the Fallopian tube was inserted into the lower portion of the uterus not far from the cervix. It is possible, as Hegar (*Monatsschrift f. Geb.*, xxi., Suppl. 1863, p. 28) *inter alios* has pointed out, that too extensive a formation of serotina may cause the placenta to project into the area of expansion of the uterus; abnormal size and relative thinness of the placenta in placenta prævia has also been mentioned by numerous authors, and I have seen several illustrations of it (*cf.* also §§ 341, 361); the part of the placenta that lies exactly over the internal os uteri is often in a state of extreme tenuity and atrophy, although in reference to this point it must of course be remembered that such a condition may be caused by manipulations during labour, or be a consequence of previous detachment. There are some observations

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[1] Ingleby, Velpeau, Hecker; I also have seen a case.

(*e.g.* Küneke, *Monatsschrift f. Geb.*, xiii., p. 344; Schuchardt, *ibid.*, xxi., p. 380; Hecker, *Klinik d. Geburtshülfe*, ii., p. 108) which seem to show that an abnormal formation of the placenta, especially the existence of placenta succenturiata, which I have once found in such a case, may be a cause.

Placenta prævia is on the whole rarer than would be supposed from the records of Lying-in Hospitals; for an unusual proportion of abnormal cases seek admission into the latter. Schwarz (*Mon. f. Geb.*, viii., 1856, p. 108) found that amongst the population of Hesse-Cassel, it occurred 332 times out of 519,328 labours, *i.e.* in the proportion of 1 : 1,564; in the Oberrhein-kreis of Baden 62 cases occurred amongst 52,792 labours (21,000—Schwörer, 11,000—Hegar, 20,792—I) = 1 : 852. We shall not go wrong therefore in assuming its frequency to be 1 : 1,000, since amongst the cases in Hesse-Cassel only those seen by medical men were counted, and a few may not have been recorded. In regard to these statistics however, it must not be forgotten that many instances of placenta prævia remain entirely unrecognised, since they end in abortion. It is probably merely a coincidence that a number of cases appear sometimes to happen together; the same thing is seen with other rare events. Primiparæ contribute about a tenth of the total number.

Progress.

§ 432. Placenta prævia predisposes to abortion. Owing to the loose vascular connections of the placenta, and to the higher blood-pressure in the placenta when inserted low, any shock is liable to cause rupture of its vessels and detachment; perhaps also shocks affect the lower portion of the uterus oftener than the upper during the first months of pregnancy (coitus, especially straining at stool). For the same reasons premature labour too is relatively common; indeed I am convinced that even the hæmorrhages which occur during the latter months of pregnancy, depend upon commencing labour, that it is not the hæmorrhages which induce premature labour, as is generally supposed, but that the converse relation is the true one. It is on this account that hæmorrhage as a general rule begins earlier, the nearer the placenta prævia is to being inserted centrally, and that labour comes on prematurely. As already explained, the detachment of the placenta and consequently the hæmorrhage are produced by the stretching of the lower segment of the uterus. This stretching is solely effected by contractions, and it is entirely unproven that it occurs during pregnancy; likewise is it unproven, that during the last months of pregnancy the lower segment of the uterus grows much more rapidly than the upper, and that therefore, the growth of the placenta being at a stand-still, a disproportion between it and the lower segment of the uterus is produced. If that view were true, hæmorrhage ought never to be absent throughout pregnancy, which of course is not the case; moreover we ought in the expelled placenta to find constant anatomical changes, differing according to the time of labour, changes which as a matter of fact are only exceptionally met with.

It is therefore only the hæmorrhage which is due to "pains," *i.e.* to parturient activity, which is "unavoidable," because physiological; that which occurs during pregnancy *apart from "pains,"* has no other significance than that met with when the placenta is implanted normally, and is therefore "accidental." It depends on rupture of a utero-placental vessel or sinus near the internal os, on partial separation of the placenta by casual circumstances, and these circumstances, owing to the peculiar anatomical relations of placenta prævia and to the greatly increased blood-pressure in it, merely arise much oftener than with a normal insertion.

While unavoidable hæmorrhage is therefore always due to "pains," this does not necessarily imply that "contractions" coming on before the full time, must immediately lead to labour; a quiescent condition may return, the "pains" may cease, the hæmorrhage be checked by thrombosis of the wounded vessels, and the true work of parturition only set in later. This view explains why in most cases the first attack of hæmorrhage begins only a short time before labour, "within the last fortnight of gestation"; it is a result of the commencing, but slowly progressing, parturient activity. Thus also is to be explained the varying character of the hæmorrhage, in so far as it depends on the variety of placenta prævia. Since the expansion of the lower segment of the uterus through the contractions progresses from below upwards and becomes less and less considerable in the same direction, the very first "pains" must with a central insertion cause detachment and therefore hæmorrhage; in such a case the latter must, as clinical observation shows that it does, appear earlier and be more profuse than with marginal or lateral insertion, since in the latter the expansion of the area of placental attachment takes place later and is less extensive. It is in the latter variety of placenta prævia moreover that premature labour is rarest, and indeed *labours at full time* may be met with in which no hæmorrhage occurred during pregnancy.

§ 433. Bleeding usually begins quite unexpectedly and suddenly, without premonitory signs; often when the patient is quiet in bed, the contractions which cause the hæmorrhage (sc. the expansion of the lower segment of the uterus) being unperceived by the woman herself. But it is still oftener caused by an apparently trivial cause, especially after movements of the body, straining at stool, and the reason is easy to see. The loss of blood will vary in quantity with the extent of expansion and of placental detachment; the first bleeding may be so profuse as to cause extreme anæmia, and if it returns soon, the pregnant woman may die undelivered. Such cases however are exceptional; in the majority, the first attack is slight, and when the process of expansion is arrested, and under the influence of the syncope which the bleeding produces, the hæmorrhage soon stops. Labour may either follow at once, or a period of complete intermission ensues, now and again interrupted by a *guttatim* flow of blood (stillicidium sanguinis). This alternation may occur more than once. The subsequent attacks of bleeding are almost always more copious than the first, but they are specially severe during the first stage of the period of dilatation; for at this time the expansion of the lower segment of the uterus progresses rapidly, and the separation of the placenta is very considerable; during this period also the edges of the internal os and the adjacent portions become retracted from the placenta in a very short space of time, and this also must tend to enlarge the bleeding surface. But the greater the expansion that has taken place, the further the detachment of the placenta has advanced before distinct parturient activity begins, the less will remain to be accomplished during the period of dilatation. This throws light on the not uncommon clinical fact that in those cases in which the bleeding has been very profuse before labour, the loss during it is relatively slight or even absent; and on the converse fact that when the hæmorrhage only appears during the period of dilatation, it is usually very abundant.

As a rule the bleeding lasts longer, the larger the portion of placenta that is inserted on the area of passive expansion: there are however numerous exceptions to this rule, which depend on the degree of detachment that has already taken place, and largely on the varying efficiency of the natural agencies for arresting hæmorrhage which are at work in these cases. The hæmorrhage usually ceases, when the lobe that is situated over the os is detached, and also after the rupture of the membranes, owing to the diminution of the uterine surface which then sets in, and to the pressure exerted by the fœtus on the bleeding area.

In rare cases the entire placenta is detached, while lying below the fœtus, and passes out of the cervix (*cf. infra*) before it, without the hæmorrhage persisting all the time; still more rarely the child has been observed to bore a hole through a placenta whose edges are still adherent, and to pass through it. Both events probably happen by the child pushing the placenta before it, since this can scarcely be so small or the insertion so exactly central, that the whole placental circumference could lie within the area of *spontaneous* detachment. If in such a case the edges are but loosely adherent, the placenta will be entirely detached; if firmly adherent and able to resist the pressure of the presenting part, it will be broken through.

§ 434. The *character of the pains* is of great importance. Unhappily they are generally feeble and ineffectual, doubtless in consequence of the general weakness of the uterine parietes which has also played a share in the ætiology, and especially of the slight development of the musculature at the lower segment, where the muscular element has made room for the great number of blood-vessels. Hence it comes to pass that this segment is but little irritable, there is no adequate stimulus to contractions, with which may also be associated the fact that the bag of membranes is not formed as early as usual. For these reasons the os uteri dilates slowly, and since the bleeding will only cease when the latter has attained a certain size, not uncommonly only with labour, the delay leads to great danger. Happily in spite of the slow dilatation of the edges and of the parts adjacent to the os, the latter becomes more and more yielding and dilatable, even though the pains be feeble, so that it is generally possible to terminate labour much earlier than might be supposed from the size of the os.

Until lately it was believed that this hæmorrhage was characterised by the circumstance that (in contrast with hæmorrhage due to the detachment of a normally implanted placenta) it took place during a pain owing to the increased detachment of the placenta which the pain produced, and that the hæmorrhage ceased with the intermission. This however is not correct, as Legroux already showed; I never saw a case in which the hæmorrhage was more profuse during a pain than during the intermission, if I leave out of consideration the expulsion by the "pain" of the blood that had been already shed, nor on the other hand have I ever seen any cessation of the hæmorrhage during the intermission, which could be brought into causal connection with it. It would moreover be expected on *a priori* grounds that a "pain" and the uterine anæmia which it produces, that the retraction of the area of placental attachment, and the approximation of the walls of the uterine sinuses which occurs during the latter retraction and with the expansion of the lower segment, would cause the hæmorrhage to diminish, or even to cease. This corresponds with our experience that when pains are strong and the labour makes rapid progress, the hæmorrhage is always slight.

§ 435. The *presentation of the fœtus* is comparatively often unfavourable; this is not so much due to the low insertion of the placenta, as to the frequency with which premature labour accompanies placenta prævia, and to the flaccid uterine walls. I cannot concur in the view that the low insertion alters the natural shape of the uterine cavity, and is thereby apt to cause an abnormal presentation; the adherent placenta is too thin to exert any such marked influence. The *insertion of the umbilical cord* is not infrequently a marginal one, and indeed the insertion is often into the lobe lying close to the internal os, a fact which favours its prolapse; sometimes moreover the insertion is velamentous, in which case the umbilical vessels may present, and be injured when the membranes rupture.

Placenta prævia disposes to hæmorrhage during the *after-birth period*, probably owing to the general feebleness of the pains in this affection, and still more owing to the slight development of the musculature at the placental area; partly also owing to the bruising and injury to which the latter is so often subjected during the labour which frequently requires artificial interference; and lastly owing to the fact that the clots that should adhere to the area of attachment, and that favour thrombosis of the vessels when the placenta lies low, are not rarely absent, or have been forcibly removed. This variety of post-partum hæmorrhage is exceedingly serious, since it usually attacks a woman who is already highly anæmic.

§ 436. The great *danger associated with placenta prævia*, can be easily estimated from what has been said above; there are few complications of pregnancy which are so much to be dreaded. The risk to the *mother* arises not only from hæmorrhage, but also from the frequency with which puerperal diseases start from the exposed placental area. The earlier the hæmorrhage sets in, the oftener it returns before actual labour, the more anæmic the woman when the latter begins, the feebler the pains, the greater the delay till the os becomes sufficiently dilated, the worse is the prognosis; the mode of treatment adopted of course also affects her prospects. In hospitals and towns, such cases are as a rule more successful than in rural districts where assistance is generally not obtained till late; if therefore the mortality in the former amounts to 20—25 per cent. (according to a series of quotations in Nægele-Grenser's *Lehrbuch* 21, Simpson 27·5, Barnes only 9, I not quite 16 per cent. out of 102 cases), we may estimate the general mortality including deaths from puerperal disease at 30 per cent. (Schwarz in Hesse-Cassel gives 25 per cent.)

The prognosis is even worse for the *fœtus*; its mortality in my experience has been somewhat over 50 per cent., Schwarz puts it at 75 per cent., Barnes at 64 per cent. &c. The great danger depends mainly on an insufficient supply of oxygen to the fœtus (for it does not lose any blood from the detached placenta) due to the separation of the placenta, and to the pressure to which the deeply inserted umbilical cord is exposed during labour, and on the fact that the fœtus is generally born prematurely; to these risks must be added the frequent operative measures that are called for by the abnormal presentation, and the necessity of terminating the labour rapidly.

§ 437. Placenta prævia can be easily *diagnosed* by the character of the hæmorrhage and by a vaginal examination. Any hæmorrhage coming on during pregnancy without adequate external cause, when the patient is quiet and without any distinct painful sensations ought to arouse suspicion, especially if it soon ceases and recurs after some time. Moreover in such cases the placenta can generally before long be felt above the internal os, since the hæmorrhage is caused by contractions, and these soon make the os passable to the finger; this sign renders the diagnosis certain. A great deal depends on the practitioner getting a clear idea of the state of things at an early stage; it is his duty therefore to seek to arrive at a clear diagnosis as soon as possible by the method mentioned above, while of course using every precaution so as not immediately to provoke fresh pains and hæmorrhage. The spongy reticulated placental tissue is unmistakable, and can only be confused with firm coagula through carelessness; there is more risk of mistaking thin portions of the placenta which have become atrophied (either from the very first, or in consequence of prolonged separation) and lie above the internal os, for thickened membranes. The other appearances in the generative organs throw no special light on the case; at most does an unusually soft and spongy condition of the vaginal fundus and of the lower uterine segment deserve notice, as well as a perhaps sometimes unusual thickness of that segment, which makes it difficult to feel the presenting part through it.

Management.

§ 438. There are few complications in which the results depend so much on judicious management, as they do in placenta prævia. The above description shows that the chief danger arises from hæmorrhage; and on its character must depend the conduct of the accoucheur; if the bleeding is alarming, his one object must be to arrest it, or if this cannot be done, to restrict it within the shortest possible limits.

The arrest of the hæmorrhage at the area of placental attachment is mainly brought about by contraction or diminution of the latter, by the consequent narrowing of the wounded vessels, and to a less extent by thrombosis of their lumina. *A satisfactory degree of contraction however is only possible, when the uterus is completely emptied; and the end therefore which must* *above all things be kept in view, is to effect this as quickly as possible. When this cannot be done, a partial evacuation may sometimes be useful. Should there be obstacles or reasons against either proceeding, an attempt must be made to promote coagulation at the bleeding surface.*

Hence in any special case, the following methods will need consideration.

§ 439. If the hæmorrhage is only moderate in quantity, whether distinct pains are present or not, a purely expectant attitude should be adopted, much as is recommended in the case of similar hæmorrhages due to abortion; there is at least room for hope that even when the bleeding has begun before the natural end of pregnancy, the latter may continue for a while interrupted. This treatment is further recommended by the fact that under the existing circumstances the diagnosis is not as a rule quite certain; but the patient and her friends should have their attention called to the condition, and be urged to call in assistance as soon as any unfavourable symptoms show themselves.

If the hæmorrhage continues for a considerable time or becomes profuse, we must interfere and indeed endeavour to *deliver as quickly as possible by version and extraction.* Early delivery offers the best chance for the child also, which may not as yet have experienced any want of oxygen; and even if such want comes on during the proceeding, it is not so dangerous, and is more easy to remedy after delivery than is asphyxia that has developed slowly. Delivery is in these cases often possible at an unusually early period, although the cervix appears as yet to be but little canalised, owing to the very spongy condition and to the slight development of the muscular tissue in the lower segment of the uterus, all the more so as we shall generally be dealing with multiparæ. Nor should the term "forced delivery" ("accouchement forcé") alarm the accoucheur, since the operation itself generally requires but little force. An attempt to dilate the os to a diameter of 5·5—6·5 cm. (ca. 2—2·5 inch) by the hand (more is not necessary to admit the latter and the fœtus in the great majority of cases—Duncan), often meets with quite an unexpected measure of success and must therefore always be made at the earliest moment. Chloroform anæsthesia greatly facilitates the operation, and need not be feared except for persons that are already very anæmic. In case of necessity, it may be well to make a bilateral incision 2 cm. (·75 inch) deep through the edge of the os; this will not wound the placental area. But before resorting to these measures, it should be borne in mind that, if possible, they must not remain mere experiments, but actually lead on to delivery; and further that owing to the detachment of the placenta produced by the fingers, the most profuse hæmorrhage may meanwhile set in and compel the completion of the proceeding.

The bed, &c., must therefore be carefully prepared. The choice of hand is unimportant; that should be selected by which the accoucheur will be able most easily and quickly to reach the feet; it can scarcely be difficult to discover their situation. The attempt to determine on which side of the lower segment of the uterus least of the placenta is inserted, usually proves fruitless; nor does the advice that the uterus be entered on the left side, because the smaller lobe generally lies on that side and less of the placenta will therefore be detached, always hit the mark; if the hand should come upon the more extensive portion of the placenta, it may easily be moved away to one side of it, and be pushed on past that portion. Promptness, steadiness, and fearlessness are essential; there must be no nervousness or hesitation on account of the flooding. As soon as the hand has got entirely into the cavity of the uterus, the fore-arm acts as a tampon, and the hæmorrhage is usually checked; but the operator must not allow himself to be unnerved by the blood that is lost on withdrawing his hand or on bringing the breech down into the cervix, although it is often very copious.

The extraction must be done slowly and deliberately; if the fœtal pulse permits, the expulsion as far as the navel at any rate may be left to the pains, the latter being stimulated and assisted by expression; if the fœtus is dead, only the most essential and gentle manipulations must be used. This caution is called for on account of the risk of the abdominal vessels becoming excessively engorged with blood, and of the consequent cerebral and cardiac anæmia, which conditions are so apt to follow rapid evacuation of the uterus; as well as by the fact that in forced extraction the previously stretched edge of the os is apt to constrict the neck of the child, and then to be drawn down as a result of the traction to near the vulva.

The results which follow very early delivery are extremely satisfactory. Hofmann (*Prager Vierteljahrschrift*, 1860, iii., p. 98) only lost 2 out of 33 women=6 per cent.; Hecker lost 3 out of 40 cases delivered in this way=7·5 per cent. and=4·3 per cent. of all his cases; I out of 102 only 6=5·9 per cent., and these through acute anæmia[1]; my total mortality is something under 16 per cent., and mainly due to intercurrent and secondary diseases; even then however it is by no means a bad one when compared with the mortality given in § 436.

§ 440. But if the cervix is not sufficiently canalised and dilatable, so that immediate delivery appears out of the question, *plugging* must be resorted to, not with india-rubber bags which exert but slight pressure on the lower segment of the uterus, but in the way described in § 417. The tamponing causes the blood to coagulate both at the bleeding surface and in the lumina of its vessels, partly by means of the pressure it exerts from without and by the relative diminution of pressure in the uterine vessels caused by that external pressure, partly by the fact that the blood collecting on the tampons coagulates; tamponing also excites and strengthens the pains, and thus helps in preparing the cervix for early delivery. If the cervix is still far from dilated, plugging the vaginal fundus can be rendered more efficient by introducing a disinfected sponge tent into the cervix, or still better a laminaria or tupelo tent, whose influence in promoting dilatation and expulsion is particularly useful in these cases. If after removal of the tampon, the cervix seems to be sufficiently prepared to allow of version, the latter must be immediately performed.

When the liquor amnii is discharged prematurely, and rapid delivery is nevertheless not possible, the condition may become very serious, since the plugging involves a risk of internal hæmorrhage, the amount of which may exceed that of the discharged waters. Happily this premature discharge almost only occurs, when the placental insertion is lateral. If the hæmorrhage should be considerable, it is a good plan under these circumstances to plug the cervix and vagina for a short time, while constantly watching and compressing the uterus from without; delivery must of course follow as soon as possible.

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[1] Out of these 6 cases, 2 were brought into the hospital in a state of extreme anæmia, indeed at death's door.

§ 441. The other modes of treatment that are generally recommended, possess but little value in comparison with the procedure just described, for this reason especially that (as Hecker has so justly remarked) they impose upon the "pains" the double task of checking the hæmorrhage and completing the delivery, a task which those pains are as a rule quite unable to fulfil within such a period as is compatible with the safety of the mother and of the fœtus. To this class belongs in the first place *Braxton Hicks' method of version*, in which it is recommended that even though the cervix be but little prepared, the feet be brought down into it, by means of bimanual manipulations. Apart from the fact that the feet are not always readily got hold of, and that the manipulations about the internal os may cause extensive detachment of the placenta and lead to profuse flooding, the bleeding frequently persists after the thighs have been brought down into the cervix. The operator is then in the awkward situation which he has himself produced, of having allowed the liquor amnii to escape, and of being obliged to complete the extraction while the parts are as yet insufficiently prepared. The object of the proceeding, viz., that of plugging the bleeding surface by means of the breech, is not attained, since the bleeding surface lies higher than the latter when it is occupying the cervix; the recommendation of this procedure rests on the erroneous assumption that the hæmorrhage takes place from the upper portion of the cervix, and that the placental area remains throughout the labour in the same position that it occupied at its commencement, which is of course not the fact, since the internal os is gradually, although slowly, retracted upwards.

For the same reason *puncturing the membranes when the head presents* is as a rule not advisable. In the first place so long as the os is but little dilated, it can only be carried out with a marginal insertion. When it then operates favourably (as often happens), it does so by the diminution of the bleeding area which follows upon the discharge of liquor amnii; even although it seems as if the descending fœtal part arrested the hæmorrhage by pressing on the bleeding area, such cessation is really due to the further diminution of that area which gradually takes place as the child descends. Hence as a matter of experience the method is only successful, if pains are present and soon fix the presenting head in the brim, or force it still further down. Unhappily in cases of placenta prævia, inertia of the uterus is common, and the version must often follow upon the puncturing of the membranes, and if so it is of course done under less favourable conditions than if it had been performed forthwith. It is better therefore that the whole affair be done at once.

§ 442. Nor can I speak well of the proposal that *when the placenta lies in front of the child, it should be entirely or partly separated, and delivery then be left to nature.* The *complete* detachment which was recommended by Simpson is based on the observation that the hæmorrhage frequently ceases after complete spontaneous separation, probably because the bleeding surface can then become both contracted and tense. Arrest of the bleeding however does not always follow, especially when the detachment is artificial, since the uterine muscle is so often quiescent at the time. Moreover such complete detachment often presents great difficulties; it can rarely be accomplished satisfactorily, and wastes time. Again, copious flooding may occur during the actual operation, and the bleeding area possibly be increased far beyond what is necessary; above all it should be borne in mind that the child is inevitably sacrificed. And if, in spite of the detachment, persistent hæmorrhage should compel delivery in such a case, this will be accomplished under much less favourable conditions than would obtain before such detachment. If therefore the cervix is so patulous that the placenta can be conveniently and easily peeled off, it is better to perform the easier and less dangerous version and extraction.

Partial separation (of the smaller lobe) followed by puncture of the membranes (Credé, Cohen, Barnes) is in some measure open to the same objection that it prematurely increases the bleeding surface; partly also to that already made to puncturing the membranes, namely that it takes it for granted that good pains will follow such puncture; if such are absent, we are no better off than before.

Earlier methods consisted in *breaking through the placenta with the hand, and then performing version and extraction* (Merriman, Löwenhardt), a plan which was suggested by the observation that in rare instances a placenta which adhered firmly with its edge has been perforated by the presenting part of the fœtus; or in *applying cold irrigations to the bleeding* *surface after detachment of the part of the placenta which lay nearest to the os* (Seyfert); or in *crushing the placenta* (Pfeiffer). At the present time they can scarcely have more than a historical interest.

§ 443. If a patient is not seen till she has lost much blood, and has become *extremely anæmic*, delivery must only be undertaken after a most careful estimation of the anæmia and risk of collapse. Unless existing hæmorrhage calls for immediate interference, the woman should be allowed to recover as much as possible under the use of stimulants and restoratives. The delivery must always be performed slowly, all change of posture being avoided; it must therefore be done in the ordinary bed. Chloroform is inadmissible in these cases, since this like movements of the exhausted woman might easily render the collapse fatal, and lead to pulmonary embolism.

The *after-birth period* is to be managed like that of an ordinary labour (§§ 197 and 198); after a placenta prævia however the uterus should be watched with special care, beginning with the last stages of the birth of the child. In spite of this care it will be necessary in a good many cases to remove the placenta artificially, owing to the adhesion of one or two thin cotyledons. After such removal the abdomen should be surrounded with a tight binder, supplemented if necessary by a compress, so as to insure good retraction of the uterus. If hæmorrhage occurs from the insufficiently contracted or entirely atonic placental area, irrigations of cold water or of water and vinegar, or of tr. iodi, and even of liquor ferri perchloridi should be used to stop it; the cervix and vaginal fundus may, if necessary, be firmly plugged, while pressure from above (made first with the hand, afterwards with a pad and binder) meanwhile prevents the uterus from ascending, and compels it to remain contracted, and to keep in the place it had assumed. Such all round pressure will prevent any blood escaping either upwards or downwards, and associated with the direct application of hæmostatics must arrest the hæmorrhage.

Extreme anæmia and weakness during and after delivery require the treatment that will be described, when we come to deal with hæmorrhage during the after-birth period.

Prolapse of the Placenta.

§ 444. Under this name has been understood since the time of Osiander (*Gem. Deutsche Zeitschrift f. Geburtskunde*, vii., p. 223) the *entire detachment and expulsion of the placenta before the fœtus*. Although most often seen in conjunction with placenta prævia (its mode of origin in these cases has been already mentioned in § 433), prolapse of the placenta sometimes occurs when the placenta is normally inserted, especially in the case of the second of twins. This is well illustrated by the two cases related by Hüter (*Deutsche Klinik.*, 1852, No. 49) and Scanzoni (*Lehrbuch*) in which at the necropsy the placental area was found in the fundus uteri, and by one of Hecker's (*Bayr. Intelligenz-Blatt*, 1871, No. 17). Hennig met with a case in which a couple of days before the "forced delivery," two small placentæ succenturiatæ were spontaneously discharged, while the laterally presenting placenta remained *in situ* (*Arch. f. Gyn.*, viii., p. 337). It is obvious that when a normally inserted placenta becomes prolapsed, the membranes must be torn, and a want of adaptation of the lower fœtal end to the lower segment of the uterus is also a necessary condition; the accident is therefore most common in premature labours and with pelvic presentations.

The *diagnosis* is clear if a placenta which at one time could not be discovered in the lower segment of the uterus, is during the course of labour suddenly found entirely or partly within the os. If the patient is only seen when the placenta lies in the latter position, it can scarcely be possible to distinguish between placenta prævia, and a placenta which was at first normally inserted and has become prolapsed. Such a distinction however is of no importance as regards *treatment;* for in either case this will depend on the state of the mother and of the child. The latter is not always dead, even when the placenta is prolapsed; it may be still living, if only a short interval has elapsed between the separation and the prolapse of the placenta, but it is a question of minutes, at most 10. Such a condition however is rarely met with; the detachment will almost always have preceded the prolapse so long, that the fœtus has succumbed to asphyxia. If there still remain signs of life, the child must be withdrawn as rapidly as possible from its perilous position by artificial extraction. Should the fœtus be dead, the accoucheur may look on quietly, if there is no hæmorrhage; but if there is, delivery must here also be at once completed, since plugging is not reliable (on account of the risk of internal hæmorrhage); extraction will probably always be possible, if the os is sufficiently dilated to permit a placenta to pass through.

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